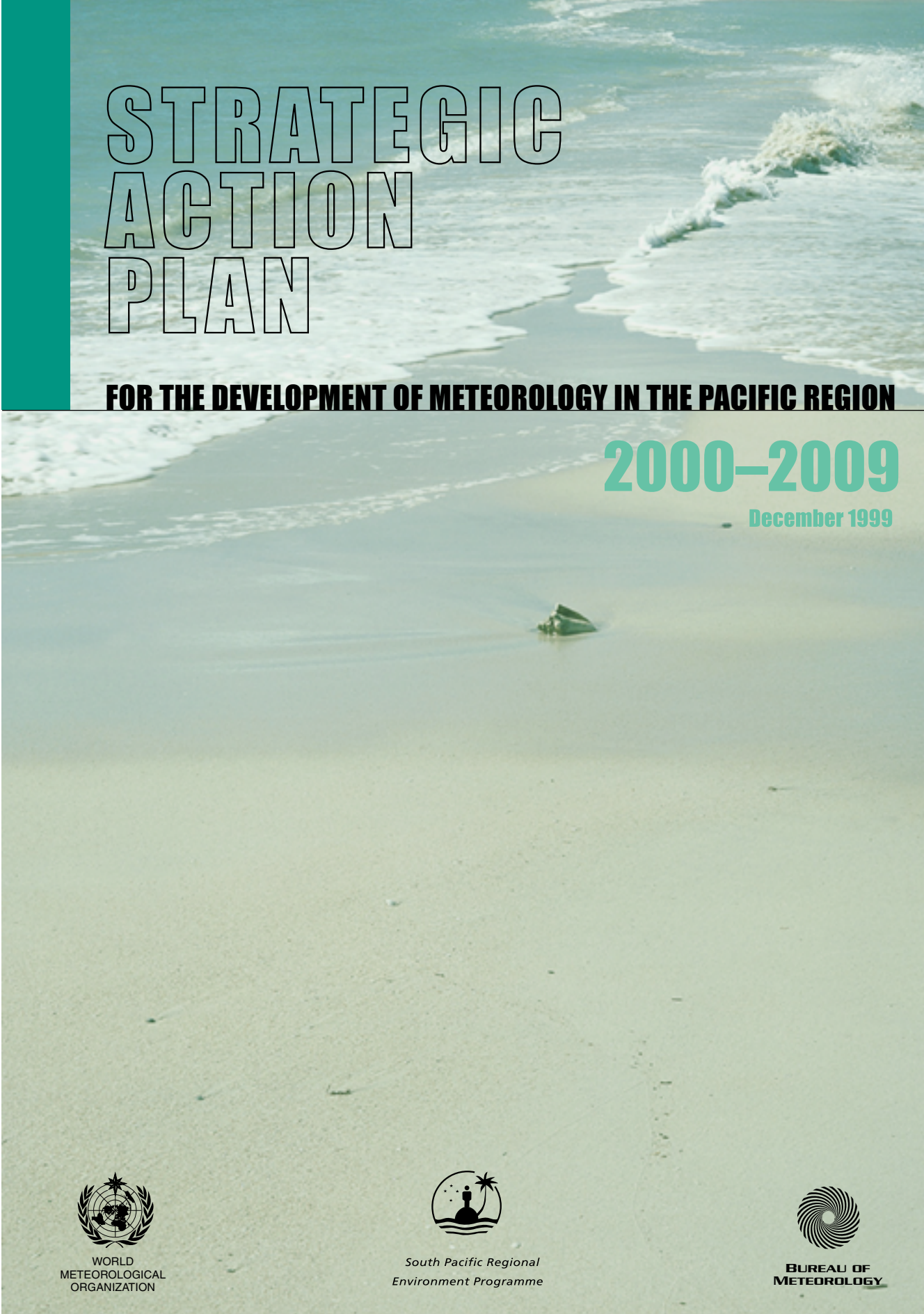

# STRATEGIC ACTION PLAN

## FOR THE DEVELOPMENT OF METEOROLOGY IN THE PACIFIC REGION

## 2000–2009

December 1999

WORLD METEOROLOGICAL ORGANIZATION

South Pacific Regional Environment Programme

BUREAU OF METEOROLOGY

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Published by the Bureau of Meteorology 2000

## Countries Participating in the Plan

*American Samoa*
*Australia*
*Cook Islands*
*Federated States of Micronesia*
*Fiji*
*French Polynesia*
*Guam*
*Kiribati*
*Marshall Islands*
*Nauru*
*New Caledonia*
*New Zealand*
*Niue*
*Northern Mariana Islands*
*Palau*
*Papua New Guinea*
*Pitcairn Island*
*Samoa*
*Solomon Islands*
*Tokelau*
*Tonga*
*Tuvalu*
*United States (Hawaii)*
*Vanuatu*
*Wallis and Futuna*

# Foreword

In 1993, SPREP organised the First SPREP Meeting of Regional Meteorological Services Directors (RMSD) in Port Vila, Vanuatu. The meeting originated from a recommendation contained in the report "Changing Climate in Paradise" prepared by the Australian Bureau of Meteorology for the World Meteorological Organization (WMO) in 1991. The aim of the meeting was to provide a forum for Directors of National Meteorological Services (NMSs) from SPREP member countries to promote the development of regional initiatives to assist members in the formulation and implementation of regional cooperation programs in climate change activities. Four other meetings followed between 1994 and 1997.

At the fifth meeting held in Honolulu, Hawaii, in November 1998, the Directors recognised the importance to the Pacific region of providing an integrated program of forecast and information services which addressed the continuum from weather to climate and included issues related to hydrology and water resources. The Honolulu meeting also noted the critical role SPREP played in supplementing WMO and national efforts in the areas of weather and climate. The meeting urged SPREP to continue to provide a forum for NMSs in the Pacific region to further promote collaboration amongst NMSs in the Pacific, to develop shared solutions to common problems, to enhance awareness of weather and climate issues and to identify opportunities to improve regional capacity to forecast, understand and address the impacts of weather and climate.

In order to achieve these objectives, the Honolulu meeting unanimously agreed for SPREP to broaden its scope of work to cover meteorology and climate matters in addition to its climate change programs. The meeting also urged SPREP to develop a long term strategic plan for the development of meteorology in the Pacific region taking into account the WMO Fifth Long Term Plan and the priority areas agreed to at the WMO Regional Association V (RA V) meeting held in Bali, Indonesia in September 1998.

Early in 1999, in response to the recommendation from the Honolulu meeting, SPREP began drafting the Strategic Action Plan for the Development of Meteorology in the Pacific region (SUMP), (2000-2009) with assistance from the Bureau of Meteorology, Australia. The draft SUMP was presented for review and endorsement to the Sixth SPREP Meeting of RMSD held in Tahiti, French Polynesia, in July 1999. The Tahiti meeting strongly endorsed the concept of preparing an integrated regional strategy, as outlined in the draft SDMP, which effectively reflected the collective expertise and assets of all countries, regional organisations and collaborating partners engaged in addressing critical meteorological and climate issues in the region. The SDMP, which forms the basis for this plan, was unanimously adopted at the Tahiti meeting.

This Plan is the collective result of the inputs of SPREP member countries, NMSs, regional and international organisations and donors since the 1993 Port Vila meeting. SPREP would like to thank all Directors of NMSs, regional and international organisations and other collaborating partners who contributed to the finalisation of this plan. I am especially grateful to Dr John Zillman, Dr Bob Brook, Mr Ram Krishna and Ms Dawn Thistlethwaite, all of the Bureau of Meteorology, Australia; Mr. Gerald Miles, Mr.

Penehuro Lefale, Ms Fono Valasi of SPREP; and Mr. Henry Taiki, WMO Sub-regional Office for the South West Pacific, for putting together the first draft of the Plan.

The success of the SDMP will rely heavily on the full collaboration of all parties involved in the development of meteorology in the Pacific region. SPREP looks forward to working with all our members and collaborating developmental partners to implement this plan.

Tamarii Tutangata

Director

SPREP

# Executive Summary

## *Background*

The Strategic Action Plan for the Development of Meteorology in the Pacific Region (2000-2009) (SDMP) has been prepared in response to a recommendation of the 1998 Fifth SPREP Meeting of Pacific Meteorological Service Directors (5RMSD). The meeting urged the SPREP Secretariat "to develop a long term strategic plan for the Pacific Region taking into account the World Meteorological Organization (WMO) Fifth Long Term Plan and the priority areas agreed to at the WMO Regional Association V meeting in Bali, Indonesia in September 1998.

National Meteorological Services (NMS) play a fundamental role in the planning and implementation of many regional and international programs and activities. The success of these programs and activities is often critically dependent on the capacity and capabilities of the Services. It is thus vital for the Services to be of an appropriate standard. They are also required to undertake a number of national responsibilities, or to contribute to national obligations under many international agreements and conventions. This strategy seeks to ensure their ability to fulfil these functions and obligations.

## *Vision*

The vision of the SDMP is for all meteorological services in the Pacific region being able to provide all appropriate meteorological services to their nation through skilled and fully trained professional, technical and support personnel operating appropriate systems and working from adequate facilities within an appropriate infrastructure. It sees all NMSs in the Pacific contributing fully to the World Weather Watch (WWW) and the World Climate Programme (WCP) through appropriate observing systems, telecommunications, data processing and management systems and public weather services. In particular, it is based on the premise that NMSs play a pivotal national role in advising government in the vital areas of climate change and climate variability.

## *Goals and objectives*

The goal of this strategic action plan is to support continued strengthening of the capability of NMSs in the Pacific region to meet the growing public demands for improved weather and climate services and products to ensure the safety, security and general well-being of the people, to contribute to achieving sustainable development and to fulfil SPREP member countries' commitments and obligations under regional and international agreements and conventions.

The objectives of this plan are to:

- provide the framework for setting short, medium and long term priorities for meteorological services in the region;
- ensure these priorities are based on identified and agreed needs of NMSs;

- make the necessary links and ensure the continuity of effective programs for strengthening the capabilities of NMSs;
- raise the profile and the importance of the work of NMSs;
- promote the cooperation and coordination of all relevant developmental assistance agencies; and
- provide guidance to SPREP and WMO in the further support of NMSs in the region.

## *Current Situation*

Almost all Pacific Island countries have a national meteorological service. These services collect meteorological data which are used primarily for forecast and warning services but are also the basic data for climate monitoring. Their climatological services are generally poorly developed or nonexistent. In a number of instances, these countries rely mainly on external support to provide basic climatological services. The capabilities of NMSs in the region range from one with relatively advanced infrastructure and reasonably good capability in several areas of service provision to those with poor infrastructure and limited capability.

Recent moves by most Pacific Island governments towards self reliance have involved diversifying their economies into areas which are extremely weather and climate dependent such as forestry, fishing, water resources, industries, transportation and tourism. These initiatives have increased the demands on NMSs at a time when resources available to them are decreasing.

## *Strategy*

The strategy to ensure the NMSs of the Pacific region meet the obligations, agreements, and conventions and fulfil their roles as national meteorological agencies depends on the capabilities of the Services. The action plan identifies, in broad terms, the needs of the NMSs to achieve these ends and suggests possible ways to meet these needs. The needs and possible solutions are presented in the areas of:

- meteorological observing systems;
- telecommunications;
- infrastructure;
- climate, climate change and climate variability;
- disaster management;
- applications of meteorology and hydrology; and
- capacity building and technology transfer.

## *Action Plan*

The strategy calls for a significant needs analysis to be undertaken under the auspices of WMO in

cooperation with SPREP. This needs analysis should undertake an extensive review of the needs of all the Pacific Island Meteorological Services in the context of the RA V Fifth Long Term Plan priorities, their obligations under World Weather Watch (WWW), Fourth Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 4/UNFCCC), World Climate Programme (WCP) and other international agreements and conventions, their specific local activities in support of government, public weather and climate services and other national activities. From the review, the needs analysis should propose a developmental assistance program subdivided into projects that could sensibly be undertaken by individual donors. The plans should be prioritised, and the linkages between plans carefully drawn so that the consequences and interactions are clearly appreciated by donors. The particular aim here is to ensure that coordination between donors will be facilitated.

The next step will be the promotion of the outcome of the needs analysis, by WMO and SPREP, to all donor agencies active in the Pacific. Ideally the plan should be presented to a meeting of donors.

## *Implementation arrangements*

The progress of the strategy will be coordinated, monitored and assisted through SPREP's Meteorological and Climate Change Programme and the RA V Sub-Regional Office.

A central issue in the development of the SDMP is the need to continue to strengthen the capability of National Meteorological Services in the Pacific region to meet the growing public demands for improved weather and climate services and products to ensure the safety, security and general well-being of the people, to contribute to achieving sustainable development and to fulfil SPREP member countries' commitments and obligations under regional and international agreements and conventions.

# Contents

# 1 Introduction

## 1.1 Origin and Scope

### *1.1.1 Mandate from Pacific Islands*

The Strategic Action Plan for the Development of Meteorology in the Pacific region (SDMP) was developed in response to a request from the twenty-six Directors of National Meteorological Services (NMSs) of SPREP member countries for the SPREP Secretariat *"to develop a long term strategic plan for the Pacific Region taking into account the World Meteorological Organization (WMO) Fifth Long Term Plan and the priority areas agreed to at the WMO Regional Association V meeting in Bali, Indonesia in September 1998"*.[1]

Annual meetings of the Directors of Pacific Meteorological Services began in 1993. It was from discussions during these meetings that the recognition of a need for an SDMP grew. This has been reinforced at regional and international meetings jointly hosted by SPREP and WMO[2] where the need for the development of an SDMP for the Pacific region has been endorsed.

A central issue in the development of the SDMP is the need to continue to strengthen the capability of NMSs in the Pacific region to meet the growing public demands for improved and better weather and climate services and products. These are now seen as essential to ensure the safety, security and general well-being of the people, to contribute to achieving sustainable development and to fulfil SPREP member countries' commitments and obligations under regional and international agreements and conventions.

### *1.1.2 Scope and Purpose*

The goal of the SDMP is to develop an agreed understanding among all the NMSs in the South Pacific on priorities and goals for their individual development and mutual cooperation, and to implement a program to ensure these are achieved.

The SDMP seeks to ensure NMSs are fully equipped to address national and regional concerns and issues with respect to climate change and climate variability, public weather forecasting and warning services and related meteorological and hydrological matters. Moreover, the SDMP aims to develop an awareness and understanding amongst all parties who are involved in the development of meteorological services of the nature of these services and the benefits that flow from the work of NMSs in meeting high priority national and international developmental goals.

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[1] Recommendation 2 of the SPREP Meeting of Regional Meteorological Services Directors (RMSD), Honolulu, Hawaii, November 1998.

[2] WMO Regional Association V Meeting held in Bali, Indonesia in September 1998 formulated regional priorities for RAV which were then incorporated into the Fifth WMO Long Term Plan (2000-2009).

The SDMP seeks to generally raise awareness of the status of the work of NMSs and to develop a framework under which development assistance will be coordinated amongst the various contributing agencies.

The vision of the SDMP is for all meteorological services in the Pacific region being able to provide all appropriate meteorological services to their nation through skilled and fully trained professional, technical and support personnel operating appropriate systems and working from fully equipped facilities within an appropriate infrastructure. It sees all NMS in the Pacific contributing fully to the World Weather Watch (WWW) and the World Climate Programme (WCP) through appropriate observing systems, telecommunications, data processing and management systems and public weather services. In particular, it is based on the premise that NMSs play a pivotal national role in advising government in the vital areas of climate change and climate variability.

# 2 Background

## 2.1 The Pacific Region

The Pacific region is characterised by islands and groups of islands sharing a common thread of evolutionary and human history.[3] Mostly isolated from one another by vast areas of ocean, the peoples of the Pacific have developed unique cultures and attitudes of self-reliance. Many countries occupy extremely small habitable land areas and are solely dependent on weather-sensitive activities, particularly tourism, agriculture and fishing, for their social and economic survival. Consequently, there is potential for significant social and economic impact of changes in the weather and climate, whether these are due to natural variability or anthropogenically induced.

Additionally, the region also is geographically located in an area very prone to extreme adverse shifts in weather patterns (tropical cyclones, floods and droughts) largely associated with the El Niño or La Niña Southern Oscillation phenomenon. These pose a further serious threat to the fragile economies and social fabrics of these countries through death, destruction and suffering caused by natural disaster such as tropical cyclones. The associated diversion of resources assigned for development into recovery, reconstruction and rehabilitation is a further economic disadvantage. Climate change and the threat of sea level rise can potentially aggravate these effects.

Appropriate meteorological and climatological services applied to sensible planning have the potential to greatly minimise and alleviate many of these adversities, clear some of the major obstacles to economic growth and contribute to the sustainable development, reduction of poverty, and contribute to better living standard and self-reliance of these countries.

## 2.2 The Role of National Meteorological Services (NMSs)[4]

### *2.2.1 The need for an Official National Meteorological Service (NMS)*

The NMS is a fundamental component of the national infrastructure of all countries. The original trigger for the establishment of a National Meteorological Service was to meet governments' responsibilities to contribute to the safety, security and general well being of their citizens, and to ensure the ongoing collection and long term custodianship of a reliable national climate record for use by future generations and to fulfil countries' essential international obligations under various conventions.

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[3] SPREP, 1992. The Pacific Way, Pacific Island Developing Countries report to the United Nations Conference on Environment and Development, South Pacific Commission, Noumea.

[4] Zillman, J.W. 1998. The National Meteorological Service, Paper presented at the Fifth SPREP Meeting of Regional Meteorological Services Directors, Honolulu, Hawaii, November 1998.

Historically there have been two powerful reasons why governments establish an official national meteorological service. Firstly, the need to ensure the highest levels of professional integrity in the preparation of the forecasts and warnings which bear on safety of life and property. These must be based on full cooperation of all data and information providers avoiding competition that could to the withholding of vital data and/or the provision of dangerously confusing information to the public, especially in life-threatening situations. Secondly, the need for a high level of standardisation and long term continuity in the observational networks which provide the data needed both to secure a homogeneous and high quality climate record sufficiently reliable to detect and map very slow long term changes of climate, for example, the enhanced greenhouse effect.

### *2.2.2 The Purpose of an NMS*

The primary purpose of all NMSs is to contribute to the economic and social benefit and welfare of people. However, to achieve this end, each country places a different set of priorities on their NMS to meet its particular needs and situation. The most important function on a day-to-day basis is to provide weather and climate information, and to ensure timely and accurate forecasts and warnings of severe meteorological and hydrological events. As the weather systems of the world are always interactive, no one country can be fully self-sufficient in providing for all its meteorological services. The national networks of meteorological stations are integrated into a global weather and climate observing network under the framework of the WMO World Weather Watch and the Global Climate Observing System (GCOS). In carrying out their day to day functions in support of national economic and social activities, NMSs serve both their own and the wider global community. The most important role of NMSs in aiding longer-term planning activities and sustainable development is the collection, archiving, interpretation and application of climatological, hydrological and related information. This function is a rapidly growing part of the work of numerous NMSs. SPREP and WMO have developed useful guidelines to assist NMSs in enhancing their contribution to the goals of sustainable development.

### *2.2.3 Mission and Functions*

The most integrated NMS, operating within the international framework of the WMO, has essentially a four-fold mission of monitoring, service provision, research and international cooperation. Many NMSs have set these down in elaborated form in their formal charters or mission statements. Although each country must be expected to design its NMS in support of its own national needs and circumstance and its allocation of other meteorology-linked functions among its own, particular combination of public and private sector agencies, there are many basic functions which have historically been common to almost all NMSs irrespective of size, economic system, geographical region and state of development. The essential functions of an NMS of a member country can be summarised as follows:

- the planning, implementation, operation and maintenance of surface and upper air observing networks over its territory;
- the provision and maintenance of systems for the collection, and quality control of observational data and their processing in support of meteorological research, provision of real time weather and climate services, and assembly of a national climate record;

- the advancement of meteorological science and the development and improvement of its own operations and services through supporting research and development;
- the provision of a range of weather information, forecast and warning services to the community at large, usually through the mass media;
- the provision of a range of sector-specific operational meteorological services, through the mass media and through other channels, to such major user groups such as agriculture, shipping, aviation and the national defence;
- the maintenance of a national climate archive and the provision of climate data and climate monitoring and prediction services;
- the provision of advice on meteorological and climatological matters to other government agencies and to its national community; and
- the fulfilment of its obligations under regional and international conventions such as the SPREP Convention, the Convention of the World Meteorological Organization, United Nations Framework Convention on Climate Change, Vienna Convention, Convention to Combat Desertification and Agenda 21.

In addition to these basic functions, almost all NMSs carried out a range of other supporting activities which may be managed as an integral part of the operations of the NMS or may be provided from external sources. These may include the provision and operation of telecommunications systems for ensuring prompt and reliable integrated exchange of NMS data and products, the training of specialist meteorological staff for the NMS, the operation of supporting information technology facilities, the publication of meteorological bulletins and reports, and the maintenance of a national meteorological library of data and scientific publications.

## 2.3 National Meteorological Services in the Region

Almost all of the Pacific Island countries have a national meteorological service. These services collect meteorological data which are used primarily for forecast and warning services, but are also the basic data for climate monitoring.[5] The national climatological services are generally poorly developed or non-existent. In a number of instances, these countries rely mainly on external support to provide basic climatological services.

In general, the meteorological services in the region are small by world standards with limited resources, budgets and staff. They are overwhelmed by the need to respond to a number of policy issues and operational requirements ranging from tropical cyclones, climate variability, climate monitoring, climate change, provision of routine weather information including forecasts, and meeting the needs of industry such as aviation. Their resources are almost entirely consumed by day to day operational requirements, leaving practically no funding for research, and limited capacity to maintain their operational systems. The means their ability to carry out environmental planning and provide advice to their governments is limited. The smaller Services have very few qualified staff. The capabilities of NMSs in the region range from one with relatively advanced infrastructure and reasonably good capability in several areas of service provision to those with poor infrastructure and very limited capability.

[5] Brook, R.R. et al. 1991, The Changing Climate in Paradise, Bureau of Meteorology, Melbourne

In terms of financial resources, most Pacific Island countries continue to rely on aid and cooperative programs for their operations. These programs take a number of forms and can be bilateral, multilateral or regional. Donors can be individual countries, a group of countries, or regional and international organisations as detailed in Section 3.4.

Most Pacific Island governments have recently made moves toward diversifying their economies into areas traditionally not considered feasible, such as forestry, fishing, water resources, industries, transportation, tourism, all of which are extremely weather and climate dependent. This has placed increased demands on National Meteorological Services in a time of decreasing resources.

## 2.4 Regional and International Programs in Support of NMSs in the Region

National Meteorological Services play a fundamental role in the planning and implementation of many regional and international programs and activities. The success of these programs and activities is often critically dependent on the capacity and capabilities of the Services. It is thus vital for the Services to meet appropriate standards. This strategy seeks to ensure this outcome. Some of the more important and relevant programs and activities are outlined in the following paragraph.

### *2.4.1 Regional Programs*

#### *2.4.1.1 SPREP Climate Change Programme*

The Programme's main objective is "to provide an understanding of, and a capacity to respond to climate change and sea level rise, particularly through adaptation strategies." To achieve this, the Programme implements, coordinates or contributes to a wide range of projects. SPREP manages, or is actively involved in, several of the projects described below. It also organises and obtains funding support for the annual SPREP Meeting of Regional Meteorological Services Directors (RMSD), and facilitates the participation of meteorological service personnel in international climate change and WMO meetings. Following the signing of a Memorandum of Understanding between WMO, SPREP and the Government of Samoa, the WMO Sub-Regional Office for the South West Pacific is co-located within the SPREP headquarters in Apia, Samoa.

#### *2.4.1.2 Pacific Island Climate Change Assistance Programme (PICCAP)*

The PICCAP is a major project funded by the Global Environment Facility (GEF) to develop the capability of countries to prepare their National Communication Reports as required of them under Article 12 of the UN Framework Convention on Climate Change (UNFCCC). The goal is to enable Pacific Island countries, who have signed and ratified the UNFCCC, to fulfil their obligations with respect to greenhouse gas inventories and mitigation, vulnerability assessment, adaptation options, national implementation plans, and the preparation of National Communication Reports. The first phase of PICCAP began in 1997 and is expected to be completed in 1999. A second phase (PICCAP2) has already been formulated and submitted for consideration by the GEF Council. PICCAP is executed by SPREP. A second phase (PICCAP2) project brief has been formulated and submitted to Pacific

Island governments and potential donors for expressions of interest. It is planned that after consultation with governments and donors a final project document will be submitted to the Global Environment Fund Council in early 2000.

#### *2.4.1.3 Meteorological Programs*

All member countries of SPREP have on-going meteorological programs, which are essential foundations to the SPREP Climate Change Programme. SPREP coordinates regional meteorological programs with the aim of building the capacity of NMSs. Most of the programs and activities under this Programme are largely implemented locally and funded through a range of aid support. Examples include the on-going program of support for equipment and staff training provided by New Zealand, Australia, US NOAA National Weather Service, Meteo France and WMO.

#### *2.4.1.4 South Pacific Sea Level Rise and Climate Monitoring Project*

A major long term program to monitor sea level rise in the region has been implemented by Australia in cooperation with SPREP since 1991. The project is in response to Forum Island governments' concern about global warming and greenhouse effects, and their impacts on climate change in the region. The project is operated by the National Tidal Facility, Flinders University, Adelaide, Australia, and maintains and operates high quality sea level gauges in each of eleven Forum Island Countries. This year the Federated States of Micronesia will be added to the network.

#### *2.4.1.5 US Department of Energy (DOE) Atmospheric Radiation Measurement Project (ARM)*

This is a climate research studies project funded by the US DOE aimed at understanding the roles of clouds and radiation (solar and terrestrial) in the climate system and at reducing the uncertainties that plague atmospheric general circulation models due to these processes. The project began its operation in the Tropical Western Pacific (TWP) in October 1996 when its first semi-autonomous Atmospheric Radiation and Cloud Station (ARCS-1) was officially commissioned on Manus Island, Papua New Guinea. The second ARCS (ARCS-2) was commissioned on Nauru in November 1998. A third site is being considered for implementation in the year 2001 at a yet undetermined location. The ARM program in the TWP region is a joint collaboration effort amongst the host country's NMSs, the US DOE and SPREP.

#### *2.4.1.6 Pacific Island countries participation at UNFCCC and its subsidiary bodies (Intergovernmental Panel on Climate Change, Subsidiary Body for Implementation of the UNFCCC and the Subsidiary Body for Scientific and Technical Advice to the UNFCCC)*

SPREP coordinates the participation and provides technical and scientific advise to its Pacific Island members at the on-going UNFCCC negotiations. This project is funded by the Danish government through its assistance to Small Island Developing States (SIDS) in the Pacific.

#### *2.4.1.7 Forum Secretariat European Union (EU) Funded Cyclone Warning System Upgrade Project*

This project, funded by the EU, aims to improve information, resources and communications for tropical cyclone warning services in the region. The project works closely with SPREP, WMO and the South Pacific Natural Disaster Reduction project in the South Pacific Geoscience Commission (SOPAC).

## 2.4.2 International Programs

### 2.4.2.1 World Weather Watch (WWW) Programme

The World Meteorological Organization's World Weather Watch Programme (WWW) is the global system comprising meteorological data processing and data management centres, observing systems and telecommunication facilities to make available meteorological data, information and products needed to provide efficient meteorological services. It also includes a Tropical Cyclone Programme (TCP), in which more than 60 countries are involved (including many in the South Pacific) and satellite activities which help to ensure the provision of satellite data and products for the countries needs. WWW coordinates closely with WMO's Commission for Instruments and Methods of Observation (CIMO) to promote the standardisation and development of meteorological and related observations.

### 2.4.2.2 Tropical Cyclone Programme (TCP)

The Tropical Cyclone Programme coordinates, through National Meteorological Services, activities directed towards the mitigation of tropical cyclone disasters in the region, especially in association with the International Decade for Natural Disaster Reduction (IDNDR) and in the context of the Sustainable Development of Small Island Developing States (SIDS).

The WMO RA V Tropical Cyclone Committee for the South Pacific and South-East Indian Ocean (RA V TCC) was established in recognition of the need for regional cooperation and coordination in the operation of early warning systems. The Committee is responsible for the formulation and implementation of the regional Tropical Cyclone Operational Plan. The purpose of the Plan is to improve the capability of NMSs in providing accurate and timely tropical cyclone warning services.

An important aspect of the Tropical Cyclone Programme is the training of tropical cyclone forecasters. This is considered to be essential for a sustained augmentation of the tropical cyclone warning services provided to the public by NMSs. In accordance with decisions of the United Nations Commission on Sustainable Development, the training of forecasters in the tropical cyclone basins of Small Island Developing States are seen as a priority.

It is also important within the region to improve cooperation and collaboration between the Tropical Cyclone Programme and the Public Weather Services Programme, as they have the common aim of improving the provision of support for safety of life and property.

### 2.4.2.3 Public Weather Services Programme (PWSP)

The purpose of the WMO Public Weather Services Programme (PWSP) is to assist Member countries to improve their services to the public and give guidance on how best to use these services. The long term objectives of PWSP are to strengthen Member countries capabilities to meet the needs of the communities through the provision of weather and related services with particular emphasis on public safety and welfare, to foster better understanding by the public of the capabilities of NMSs, and to teach the communities on how best to use their services.

### 2.4.2.4 World Climate Programme (WCP)

The World Climate Programme (WCP) promotes the improvement of the understanding of climate

processes through internationally coordinated research and monitoring of climate variation and changes. It also promotes the application of climate information and services to assist in economic and social planning and development. The WCP is closely associated with the WMO/UNEP Intergovernmental Panel on Climate Change (IPCC) and the WMO/UNEP/IOC/ICSU Global Climate Observing System.

### *2.4.2.5 Global Climate Observing System (GCOS)*

The Global Climate Observing System was established by a Memorandum of Understanding among the WMO, IOC, UNEP, and ICSU. Its objective is to meet the observational requirements for climate monitoring, impacts, and prediction. Its remit includes atmospheric, oceanic, terrestrial, and cryospheric measurements from in situ and space-based instruments. GCOS will depend to a large degree, on existing systems and relevant national activities. Of special relevance to the regional responsibilities, under a number of agreements and conventions, are the GCOS Surface Network (GSN) and the GCOS Upper Air Network (GUAN) (e.g. vide COP-4, section 4.3 below).

### *2.4.2.6 Climate Information and Prediction Services (CLIPS)*

The Climate Information and Prediction Services (CLIPS) is a project of the WCP's World Climate Applications and Services Programme (WCASP). It aims to enhance climate services of National Meteorological Services by increasing the availability of broad-scale climate products on media such as the Internet and the World Wide Web. Such products will include seasonal and inter-annual predictions on a national and regional scale. The building and strengthening of partnerships between WMO and its Member countries and the newly emerging institutions dealing with climate issues will remain a matter of high priority for the CLIPS project and for WCP as a whole.

# 3 Goals and Objectives of the Strategic Plan

The goal of this plan is to:

> *support continued strengthening of the capability of NMSs in the Pacific region to meet the growing public demands for improved weather and climate services and products to ensure the safety, security and general well-being of the people, to contribute to achieving sustainable development and to fulfil SPREP member countries' commitments and obligations under regional and international agreements and conventions.*

The objectives of this plan are to:

- provide the framework for setting short, medium and long term priorities for meteorological services in the region;
- ensure these priorities are based on identified and agreed needs of NMSs;
- make the necessary links and ensure the continuity of effective programs for strengthening the capabilities of NMSs;
- raise the profile and the importance of the work of NMSs;
- promote the cooperation and coordination of all relevant agencies; and
- provide guidance to SPREP and WMO in the further support of NMSs in the region.

# 4 Agreements and Conventions

National Meteorological Services are required to undertake a number of national responsibilities, or to contribute to national obligations under many international agreements and conventions. Some of the more important of these follow.

## 4.1 The Convention for the Protection of the Natural Resources and the Environment of the South Pacific Region (the SPREP Convention)

The parties to this convention undertake to protect the natural resources and the environment of the South Pacific region. (ref South Pacific Handbook of Treaties and Other Legal Instruments in the Field of Environmental Law, 1998, SPREP, UNEP, NZODA pp 303-327.) In particular, "the SPREP Action Plan", (Chapter 2) seeks to strengthen the capacity of National Meteorological Services (ref the Action Plan for Managing the Environment of the South Pacific Region 1997-2000,1999, SPREP, Apia).

## 4.2 Barbados Programme of Action for the Sustainable Development of Small Island Developing States

Parties to this Programme of Action are encouraged to assist small island developing States to minimise the socioeconomic impacts of climate change and variability and to prepare for and respond to the increasing range and frequency of natural and environmental disasters. They are also encouraged to promote early warning systems and facilities for the rapid dissemination of information and warnings. (ref Barbados Programme for Action for the Sustainable Development of Small Island Developing States, Chapters 1 and 2, Barbados, May 1994)

## 4.3 Agenda 21 Programme of Action for Sustainable Development

Parties to the United Nations Conference on the Environment and Development (UNCED) agreed to this agenda, and specifically to protection of the atmosphere. (ref Final text of agreements negotiated by Governments on UNCED, 3-14 June 1992, Rio de Janeiro, Brazil, published by the United Nations).

## 4.4 The Convention of the World Meteorological Organization (WMO)

The Convention of the World Meteorological Organization (WMO) resulted from a Conference of the Directors of the International Meteorological Organization convened in Washington in 1947. It aims are to coordinate, standardise and improve world meteorological and related activities and encourage an efficient exchange of meteorological and related information between countries as an aid to human activities.

## 4.3 Resolution 40 of the Twelfth Congress of WMO

Under this resolution all Members of the World Meteorological Organization adopted, as a fundamental principle of the WMO, and in consonance with the expanding requirements for its scientific and technical expertise, the commitment to broadening and enhancing the free and unrestricted international exchange of meteorological and related data and products. (ref Abridged final report with resolutions of the WMO Thirteenth Congress, Geneva 1999).

## 4.6 The Geneva Declaration of WMO

The 170 Member states of the World Meteorological Organization at the Thirteenth World Meteorological Congress, May 1999, were parties to the Geneva Declaration which urges all governments to provide financial support to operate and maintain the required basic infrastructure, monitoring and services in the national and global public interest and that such support be strengthened where needed.

## 4.7 United Nations Framework Convention on Climate Change (UNFCCC)

Parties to this convention are determined to protect the climate system for present and future generations. (ref South Pacific Handbook of Treaties and Other Legal Instruments in the Field of Environmental Law, 1998, SPREP, UNEP, NZODA pp 216-231)

## 4.8 Fourth Conference of the Parties to the United Nations Framework Convention on Climate Change (COP4/UNFCCC)

Following on from Decision 8 of the third conference of the parties, held in Kyoto, Japan, from 1 to 11 December 1997, the Decisions 2 and 14 of COP 4 (2/CP.14) and (2/CP.4) urges Parties to actively support national meteorological and atmospheric observing systems to ensure that the stations identified as elements of the GCOS, based on WWW, are fully operational and conform to best practice. (ref Report of the Conference of the Parties to the United Nation Framework Convention on

Climate Change on its Fourth Session held at Buenos Aires, Argentina from 2 to 14 November 1998, United Nations FCCC/CP/1998/16/Add.1 20 January 1999).

## 4.9 The United Nations Convention to Combat Desertification (UNCCD)

Parties to this convention are committed to fight against desertification and drought. (ref Abridged final report with resolutions of the WMO Thirteenth Congress, Geneva 1999).

## 4.10 International Decade for Natural Disaster Reduction (IDNDR)

Members of WMO, through the WMO Secretariat, undertake to play a leading role with regard to mitigation of and preparedness for natural disasters of meteorological and hydrological origin through WMO's scientific and technical programs, in particular the Tropical Cyclone and Public Weather Services Programmes. (ref Abridged final report with resolutions of the WMO Thirteenth Congress, Geneva 1999).

## 4.11 The Convention of the International Civil Aviation Organization (ICAO)

This Convention, often referred to as the "Chicago Convention", was established in 1947. National Meteorological Services are in most cases the "Meteorological Authority" under the Convention.

## 4.12 The Convention of the International Maritime Organization (IMO)

The Convention was adopted at a conference in Geneva in 1948. It grew from a recognition that shipping was perhaps the most international of all of the world's great industries, and one of the most dangerous. The IMO was established to promote maritime safety, and the convention entered into force in 1958.

## 4.13 Safety of Life at Sea (SOLAS)

The International Convention for Safety of Life at Sea was adopted by the International Conference on Safety of Life at Sea in 1974. It was developed as part of the work of the International Maritime Organization. NMSs have special responsibilities in ensuring the protocols are carried out.

# 5 Challenges and Opportunities

The strategy to ensure the National Meteorological Services of the South Pacific meet the obligations, agreements, and conventions outlined above and fulfil their roles as national meteorological agencies depends on the capabilities of the Services. This section of the action plan identifies, in broad terms, the needs of the NMSs to achieve these ends and suggests possible ways to meet these needs. In order to give an appreciation of the scale of NMSs in the South Pacific, some basic statistics of the Services are presented in Appendix 1.

For NMSs in the region to adequately cope with the growing demands expected of them, they need to modernise their services, restore and upgrade infrastructure (equipment and facilities), acquire new technology, and improve and develop their staff resources.

For various reasons including the obvious economic benefits and the imperative for cooperation among nations inherent to operational meteorology and climate change, a regional approach to technical cooperation makes a great deal of sense. A collective approach to some of the challenges faced by individual Pacific Island countries' NMSs has practical and economic benefits.

While strengthening of individual NMSs is essential and should be carried out as far as practicable within the resources available, it is often constrained by limited funding and staff to meet ongoing operational needs and the capacity to absorb advanced technology. Whilst staff with high order technological skills are a requirement, these people are scarce and in individual Services are often unlikely to be used to full capacity, resulting in dissatisfaction and often migration to larger organisations elsewhere where they are in great demand.

Some of the key issues which need to be addressed follow.

## 5.1 Observing Systems

### *5.1.1 Needs of Observing Systems*

Observing systems are fundamental to the operations of all levels of meteorology. Standards of observations are achieved through internationally accepted definitions agreed to through the WMO processes. These standards ensure that meteorological data collected by individual countries are compatible between all countries. These standards are therefore of fundamental importance to the success of the effectiveness of all meteorological outputs, particularly when these are used in climate change and variability applications. It is therefore of critical importance that the observations programs of all meteorological services comply with these standards. The standards address such issues as the frequency of observations, exposure, accuracy, response times and other characteristics of

instruments, network densities and related matters. The first priority of any national meteorological service is the operation of a complying observational system.

There are a number of specific international networks to which the national networks of most meteorological services contribute, including those in the Pacific. As part of the Global Observing System (GOS) of the World Weather Watch Programme there is a defined "Regional Basic Synoptic Network" (RBSN). This network has been defined by the relevant WMO Regional Association (in the case of Pacific countries this is RA V). It specifies the surface and upper air observations that are required for exchange of meteorological data between countries. These data provide the fundamental information for all real time meteorological products and services, in particular for forecast and warning services, which are especially important for cyclone events in the South Pacific.

Under the World Climate Programme, networks have been specified as the basis of climate monitoring. These are part of the Global Climate Observing System (GCOS). The stations designated as making up this network are in most cases a sub-set of the GOS. They are chosen both for their geographical location and for the length and quality of their record. In the Pacific, primarily because of the sparsity of stations, much of the GOS forms part of the GCOS. Specifically defined are the GCOS Synoptic Network (GSN) and the GCOS Upper Air Network (GUAN). It is considered of the highest priority that these networks be maintained. This has extra importance under COP.4 (section 4.3 above).

In addition to the above observing systems, there are further observing systems relevant to the programs of the individual NMSs. These include supplementary networks to the RBSN used for national purposes, some assisting in forecast and warning services and some with more detailed specification of climate or specialised research and other needs. There are also some very specialised systems included here, such as those monitoring solar and terrestrial radiation and atmospheric constituents (e.g. ozone, greenhouse gasses and air pollutants).

Local needs may include weather watch radar. Weather watch radar, although primarily used for local forecasting and weather monitoring has an important role in tracking systems such as tropical cyclones, which is of interest and value to neighbouring NMSs.

Thus, in summary, all NMSs have needs for meteorological data relating to their own operations, and to meet their international obligations and commitments. The task of establishing and operating the networks, even the most simple ones, on which these data depend is a technically complex and demanding one. Without the necessary resources and staffing it is impossible to achieve the necessary standards to operate such systems. This may be beyond the capacity of some NMSs within the Pacific.

### *5.1.2 Possible Solutions To Problems Identified With Observing Systems*

Before any problems associated with observing networks in the Pacific can be addressed, it is critical that they be defined. It is first necessary to fully survey the current situation with respect to the RBSN, GSN and GUAN, and to identify where requirements are not being met. From this survey, each country's specific needs to meet its obligations can be determined.

In developing solutions it is absolutely vital that the technology involved is within the capability of the operators. As an example, automatic weather stations (AWS) are often seen as a solution

to difficulties in maintaining surface observations. However, the AWS may not be an appropriate solution. These systems are technically sophisticated and require frequent high-level maintenance. Typically, an observing site that is operated manually requires an inspection visit once a year and an AWS requires a minimum of two inspections per year. In the case of manual observation sites the inspector needs only to be a skilled meteorological observer. For AWSs, the inspector also needs to have appropriate electronics, Information Technology (IT) and telecommunications skills. The sensors used in AWSs are complex and specialised with difficult calibration procedures and as many as two to three people may be required to service a station. In the case of the failure of an AWS, unscheduled visits are required, which can be expensive and difficult to arrange. It is still the case that AWSs, even the most sophisticated, cannot replicate the ability of an observer in identifying meteorological phenomena, such as cloud type, weather, variable visibility and the like. Thus, before settling on the use of AWS for surface synoptic observations, a careful assessment needs to be carried out to assess the extra costs, loss of some observation elements, and the vulnerability of such systems compared with manual observations.

For surface synoptic observations in many Pacific Island countries, manual observations may be the preferred option, with assistance in setting up observing sites and associated buildings (including staff housing) as an appropriate strategy.

Where in the case of surface observations there is a choice of technologies, for upper air systems there are few options. Wind measurements have traditionally been obtained either through navigation aids based systems (e.g. GPS sondes) or wind finding radar. However wind finding radars are no longer manufactured and are being steadily phased out as an obsolete technology. This means an increasing reliance on GPS sondes. Although the ground stations for such systems are relatively simple and reliable, the cost of consumables is very high and often beyond the reach of Pacific NMSs. It is important to solve this problem. One possibility is the bulk purchase of sondes by a centralised agency and their distribution to users. The funding of this could be a mix of aid assistance and funds provided by the recipient services. It should be noted that this is an ongoing need, and requires a long-term commitment.

The "profiler"presents an alternative in upper wind systems. The profiler consists of a vertically pointed VHF radar which can determine wind profiles by analysis of the returned radio signals. This technology is still in the developmental stage, and although continuing to show promise, there are several limitations, particularly the height to which data can be supplied, and the loss of data where atmospheric conditions are not appropriate. At this stage the profiler is not considered a viable solution. However, the ability to run unattended and the expected improvement in reliability make them promising candidates as future systems.

As far as the thermodynamic parameters - temperature, humidity and pressure - are concerned, there is no real alternative to the radiosonde. In general, these will be combined with GPS wind systems. Therefore all the problems and potential solutions associated with such systems mentioned above are mirrored here.

The Autosonde has been adopted in a number of developed countries as a way of addressing resource issues specific to those Services. The Autosonde is a robotic system that can launch, unattended, up to 24 GPS sondes either at scheduled times or on demand. These systems are expensive and extremely complex. It is highly unlikely that they would be appropriate in any Pacific NMS.

Weather watch radar has the potential to offer one of the most significant contributions to the

development of meteorology in the region. A single weather watch radar can monitor activity covering, in many cases, the whole area of responsibility of a NMS and also provide tropical cyclone monitoring and tracking for nearby countries. However, its introduction presents some of the greatest challenges. The systems are possibly the most complex in the meteorological observing systems inventory. Well maintained, they are reasonably reliable, but the maintenance of weather radar systems must be an integral part of their implementation. As a single technician can maintain a number of radars, it would be inefficient for a NMS to carry a technician solely to maintain its radar. A model, addressed elsewhere in this strategy, is to have a centre of expertise serving the needs of a number of installations.

There are obvious advantages in standardising on a single radar type, or at least the data distribution formats. This will facilitate the viability of centralised maintenance. As to data format there is already a de facto standard in the region, the RAPIC standard developed by the Australian Bureau of Meteorology and used by radars in Australia, Fiji, New Caledonia, Indonesia and Malaysia. These installations in New Caledonia and Fiji are potential standards for weather watch radar in the Pacific.

The complex issues associated with maintenance of more sophisticated technologies in the region are addressed in the report "Securing Meteorological Equipment in the South West Pacific". The report is a feasibility study on the maintenance practices used to service higher order technological equipment found in participating Meteorological Services in the South West Pacific and undertaken as part of the Pacific Meteorological Services Project. (K.L.Nitschke, Bureau of Meteorology, April 1996)

## 5.2 Telecommunications

### *5.2.1 Telecommunications Issues*

Adequate and reliable telecommunications facilities are vital to the operation of meteorological services. The basic telecommunications infrastructure for communications between NMSs is the Global Telecommunications System (GTS) as defined by, and part of, the World Weather Watch Programme. Within RA V this is managed by a special RA V subgroup. In general, the GTS in the Pacific is maintained at an appropriate level, even though it is within a rapidly developing field. In particular the development of the Internet within the Pacific offers opportunities for developing the GTS. However, it is the general assessment that this area is well served for telecommunications.

At a local level, however, despite the rapid improvement of telecommunication throughout the Pacific, there are areas of real need. These are mainly in data collection from observing stations and product distribution from national meteorological centres.

### *5.2.2 Possible solutions to Telecommunications Issues*

The problem of data collection is often solved on a case by case basis depending on the local situation. However, the development of satellite communications through specialised meteorological data collection platforms (DCPs) may provide some solutions. Product distribution (e.g. weather forecasts and warnings) is very much a local matter and depends highly on local circumstances. This is an area in which individual NMSs are best placed to define there own needs. But it is one of the most important areas of the operation of services and must be included in any regional strategy for develop-

mental assistance.

The rapid development of the Internet as a method of communicating all types of information to a wide audience makes it inevitable that all meteorological services in the Pacific will eventually need to embrace it.

## 5.3 Infrastructure

### *5.3.1 Infrastructure Needs*

Modern, efficient and effective meteorological services can no longer be expected to operate from the primitive buildings that have characterised NMSs in the past. Not only have current standards and expectations changed, but also as meteorological services employ advanced technologies and develop increased requirements to maintain equipment and facilities, so the accommodation needs have changed. This has been reflected in the new RSMC and headquarters building for the Fiji Meteorological Service. There are a number of NMSs in the region who's headquarter buildings are in desperate need of upgrade.

At least one NMS headquarters building is of international historical importance. This is the Observatory at Apia, Samoa, built by Germany in the nineteenth century. This observatory is the source of one of the most important sets of meteorological and other geophysical data in the Pacific.

In addition to headquarter buildings, there is a need for appropriate infrastructure at the observing stations. The nature of such facilities will vary from location to location, depending on the functions undertaken at the site. Upper air stations will need offices to house the reception equipment, balloon inflation and hydrogen storage or generation facilities, and consumable stores. Under some circumstances housing for staff may be appropriate. If the station is to undertake meteorological information office functions, this will require special arrangements to serve the public.

### *5.3.2 Possible Solutions to Infrastructure Issues*

The specific needs for each meteorological service can only be determined by that service. Nevertheless, there is a clear need for a concerted effort throughout the region to undertake a program of building if the meteorological services are to be able to meet their national and international responsibilities in an efficient and effective way.

## 5.4 Climate

### *5.4.1 Climate, Climate Change, and Climate Variability Issues*

In recent years, climate change and climate variability issues have led to an awakening amongst PIC NMSs regarding the significance of meteorological services and placed added strain on their capacity and resources. While representation in the environment-related aspects of the climate change debate and related policy advice to governments has been adequate in most PICs, in climate, climate change and climate variability (associated with the El Niño phenomena) there has been little or no representation because of the relatively low profile of the NMSs in the Pacific compared to other regions. Continued measurement of climate variables, and hence climate change, and climate vari-

ability over a long term of at least several decades are pre-requisites for understanding and predicting climate change and extremes of climate variability, so significant for sustainable economic development. Advance seasonal prediction of droughts and tropical cyclones, now scientifically feasible, can be enormously beneficial in national planning (e.g. in the areas of water resources management, disaster management (including food security), and agricultural planning). PIC NMSs need to develop the scientific methodology and related resources to provide seasonal predictions in a form that can be used effectively by industry and government agencies.

### *5.4.2 Possible solutions to Climate, Climate Change and Climate Variability Issues*

Several initiatives in the past including the Australian Pacific Meteorological Services Project, those projects under New Zealand aid, and national inputs have consolidated the existing meteorological (incorporating climatological) networks in the region, resulting in improved quality of data. To ensure continuity of good quality long term climate records into the future (which are essential for measuring and predicting climate change and variability) and to meet the specifications of GCOS in the region, it is essential that these efforts be followed up, and where necessary, the networks be enhanced. This applies to upper air as well as surface networks of observations. The exciting possibility of the contribution of seasonal climate prediction to national planning and economic development should be explored by developing operational climate prediction schemes for each individual country. Efforts in this direction are already being coordinated under WMO's World Climate Applications and Services Programme including Climate Information and Prediction Services (CLIPS). Outputs of such programs need to be interpreted by NMSs to advise relevant government and other agencies.

## 5.5 Disaster Management

### *5.5.1 Disaster Management Issues*

The economic sustainability of these islands is continually threatened by tropical cyclones, which cause not only loss of life and immediate and long term disruption of infrastructure, but recurrent diversion of scarce national resources which might otherwise be applied for economic and social development. Given adequate infrastructure (e.g. weather surveillance radars in conjunction with satellite data, and other more traditional weather data) and appropriate skills, there is the potential for substantial improvement in the accuracy and timeliness of cyclone warnings and the securing of fixed and movable property. Prolonged severe flooding or drought associated with El Niño related climate variability often results in severe nation-wide social and economic stress. Climate change with sea level rise would substantially aggravate these scenarios. Advanced seasonal prediction of drought, a period of high tropical cyclone activity in the region, or prolonged heavy rainfall would provide valuable tools for planning purposes.

### *5.5.2 Possible solutions to problems identified with Disaster Management*

There is the potential for greater extremes of weather and climate, when climate variability is considered in conjunction with climate change. The frequency, severity and impact of tropical cyclone in the region will increase under this scenario. In many countries, tropical cyclones warnings currently provided lack the accuracy and timeliness required by disaster managers for appropriate and timely response. While traditional data together with satellite imagery and modern data processing

techniques have led to improved warnings, with currently available technology there is scope for substantial improvement, i.e.. weather surveillance radars complemented by other observational data, as is evident from experience elsewhere (e.g. Fiji). A network of strategically positioned radars, preferably close to major population centres in the region, with real-time data being shared with neighbouring countries would dramatically lift the warning capabilities of these countries, and thus of the region as a whole. It is essential that the radar data be available to the Regional Specialised Meteorological Centre (RMSC) in Fiji in a real time, dial-up mode.

Operational coordination of the regional and national warning systems under the regional operational tropical cyclone plan and national operational plans would need to continue and to be strengthened wherever necessary.

## 5.6 Other Issues

### *5.6.1 Other Issues associated with Applications of Meteorology and Hydrology*

Other appropriate meteorological (including climatological) and hydrological services sensibly applied to planning have the potential to contribute significantly to national capacity building and sustainable development. Improved data on cyclone hazards and risks formulated from historical data on extreme winds, droughts, storm surges and floods, would assist in assessing vulnerability of social infrastructure and communities and provide data for appropriate planning to reduce or remove the vulnerability. Climatological statistics based on historical data combined with tailored special weather services could help bring about greater efficiency in industries such as agriculture, tourism, commerce, engineering and transport through better operational and long term planning. These improvements in the economy would contribute to an overall reduction in levels of poverty and better living standards.

Sometimes agencies external to the region, with the appropriate resources and expertise, use national and regional data from the Pacific region to provide commercial services. Some examples are derived hydrological/rainfall/wind information for design of dams, construction of buildings, roads, bridges and aerodromes, tourist resorts, operation of fishing fleets, etc. While financial receipts from these services may in many cases be small, if PIC NMSs could provide these services, it would provide them the opportunity to supplement their budgets to a degree.

### *5.6.2 Possible solutions to other issues associated with Applications Of Meteorology and Hydrology*

NMSs need to develop and/or be provided access to appropriate data bases, resources and expertise to produce informational products and provide specialised services for the development of national planning, and for the planning and operations of local industry, for example, construction industry and shipping.

National Meteorological Services would need to pay particular attention to the selection of appropriate personnel for training to ensure the most effective outcome for the country concerned. In this context, NMSs would need to draw up five to ten year human resource development plans, embedded within the development plans of the respective services, prepared within the framework of the regional strategy.

## 5.7 Capacity Building

### *5.7.1 Capacity Building and Technology Transfer Issues*

A small number of staff are required to carry out a variety of duties, requiring individual officers to have a wide range of skills. This is compounded by the difficulty of obtaining appropriately qualified recruits, making transfer of knowledge and skills in an area of rapidly advancing technology rather difficult. Human resource development has been and will continue to pose a major challenge, but is a vital and continuing requirement fundamental to capacity building in PIC NMSs. The maintenance and development of a variety of knowledge and skills ranging from management at various levels, professional meteorology, engineering, technical maintenance, product delivery and presentation skills, weather observation skills, and computer skills are essential to deliver useful end products effectively and efficiently. Knowledge and skills in hydrology are essential for flood forecasting and water resources management.

While the climatological data base for the existing network of stations in the PICs has been growing and has been consolidated substantially through the Pacific Meteorological Services Project and other past initiatives, the climate data management capabilities essential for the measurement of climate change and providing the basis for climate information prediction services is still inadequate in several countries. Programs such as CLICOM need to be brought up to an acceptable level of standard at all NMSs.

There is a dearth of professional expertise and experience, for example, in tropical cyclone forecasting as most existing cyclone forecasters have had limited exposure to cyclone situations. The short term injection of such expertise and experience (e.g. into the Nadi RSMC and other national warning centres) would serve to satisfy operational requirements and also provide useful on-the-job training. Periodic refresher training and training on the employment of new techniques is also needed. More effective training and adequate documentation is important to improve the retention of vital knowledge.

With the very rapid growth in recent times of the use of computers in almost all facets of the work of NMSs, the demand for basic and more specialised computer skills has greatly outstripped availability in all countries. Satellite interpretation and application training in the region needs to be enhanced.

The capacity of NMSs in the provision of public weather services needs to be strengthened. Effective communication of weather information to the public designed to evoke effective response during tropical cyclone threats needs special skills in presentation (including pictorial presentation) and effective communication skills. Resources and skills for such effective communication, for example, through the media of the television and radio, are not currently available in most countries.

Management skills of the personnel of NMSs should be enhanced. There are fairly fundamental structural changes being imposed by regional governments on their respective public services, involving, in some cases, drastic reduction of resources. Management of such changes and continued delivery of services will present a formidable challenge to the already poorly resourced small services.

### *5.7.2 Possible solutions to problems identified with Capacity Building and Technology Transfer*

The range of suggested solutions above would involve capacity building at several different levels. Training is especially required in the following areas:

- the traditional skills of observing and processing data and interpretation of outputs from regional centres;
- modern computer-based skills;
- technical maintenance skills in the delivery of public weather services;
- skills, for middle and upper level management, in the provision of policy advice to governments on climate change; and
- specific forecasting skills related to provision of marine weather services, tropical cyclone warnings, climate data base management, etc.

While most of this training is currently carried out, mainly in the larger developed countries of the region, some skills, which have arisen out of more recent needs e.g. high technology equipment maintenance, computer skills (including climate data management) in rapidly evolving new areas, need to be continued and strengthened wherever required.

Resources and training in the area of public weather services need to be provided to NMSs, particularly in the effective communication of tropical cyclone related warning information.

While it may still be necessary to conduct some of the above training outside the region, the case for carrying out as much as possible locally is strong and the feasibility of this approach needs careful study. Possible options are the University of the South Pacific (including the Fiji Institute of Technology), Fiji Meteorological Service Training School, and Solomon Islands Meteorological Service Training Unit. While some training experts would need to be recruited from outside the SPREP region, every effort should be made to recruit experts with extensive knowledge of and experience in the region.

### *5.7.3 The advantages of a Regional Cooperative Approach*

Because of the small size of PIC economies, and the relatively similar technological state of their NMSs, an approach which would pool together the resources of the countries under a regional umbrella arrangement or institution (of which the Caribbean Meteorological Organization is an example), would appear to offer cost effective avenues for several aspects of the management of meteorological services in the region. The NMS would still play an important role in such a model, but with greater dependence and support from the regional institution arrangement. It would enable NMSs to focus their resources more effectively on the core function of service provision. The concept could include regionally centralised training, high order maintenance of equipment, and spare parts purchase and distribution facilities. Aspects of this have already been touched on previously in this document. The concept has political as well as economic implications. It would be useful if the concept was examined in depth in the context of regional institutions, possibly with a regionally initiated study of its feasibility.

# 6 The Pacific Regional Meteorological Strategy

## 6.1 The Purpose of the Strategy

The aim of the Pacific Regional Meteorological Strategy is to develop an agreed understanding between all the National Meteorological Services in the South Pacific on priorities and goals for their individual development and mutual cooperation, and to implement a program to ensure these are achieved. The strategy seeks to ensure that National Meteorological Services are well equipped to address national and regional concerns and issues with respect to climate change and variability, public weather forecasting and warning services and related meteorological and hydrological matters.

The strategy must accommodate the requirements of government, the public and specialised users for weather and climate services to ensure the safety, security and well being of all and to contribute to achievement of sustainable development. It must recognise the commitments and obligations which exist under regional and international agreements and conventions.

The strategy aims to develop an awareness and understanding amongst all parties who are involved in the development of meteorological services of the nature of these services, and in particular the benefits that flow from the work of NMSs in meeting high priority national and international development needs. The strategy seeks to raise the awareness of the status of the work of NMSs at all levels.

The strategy seeks to develop a framework under which developmental assistance from the various contributing agencies can be co-ordinated.

## 6.2 The Vision of the Strategy

The vision of the Strategy complements the Fifth WMO Long-term Plan (2000-2009), specifically as it relates to the Regional Association V. The relevant extract from the Plan is contained in Appendix 2.

The vision is that all meteorological services are able to provide all appropriate meteorological services to their nation through skilled and fully trained professional, technical and support personnel operating adequate systems and working from suitable facilities within appropriate infrastructure. It sees all NMSs in the South Pacific contributing fully to the WWW and the WCP through appropriate observing systems, telecommunications and data processing and management systems. The vision is based on the premise that the NMSs play a pivotal national role in advising government in the vital areas of climate change and variability.

## 6.3 The Steps in the Strategy

The first step was the endorsement by the Directors of the Pacific National Meteorological Services of the proposals contained in this document. This was agreed at the sixth annual meeting of the Directors held in Tahiti 28 to 30 July 1999.

The strategy calls for a significant needs analysis to be undertaken under the auspices of WMO in cooperation with SPREP. The needs analysis should undertake an extensive review of the needs of all the Pacific Island Meteorological Services in the context of the RA V Fifth Long-term Plan priorities, their obligations under WWW, COP 4, WCP and other international agreements and conventions and their specific local activities in support of government, public weather and climate services and any other national activities. From the review the needs analysis should propose a developmental assistance program sub-divided into projects that could sensibly be undertaken by individual donors. The program should be prioritised, and the linkages between elements needs to be carefully drawn so that consequences and interactions are clearly appreciated by donors. The aim here is to ensure that co-ordination between donors will be facilitated.

The needs analysis will require a small team of high level experts, preferably with senior management and operational experience in national meteorological services, to be available full time over a period of several months. They will be required to visit and discuss extensively with the Pacific meteorological services and to consult with potential donor agencies.

The next step will be the promotion of the outcome of the needs analysis, by WMO and SPREP, to all donor agencies active in the Pacific. Ideally the plan should be presented to a meeting of donors.

It is unlikely that all the proposals coming from the needs analysis will be taken up at one time. Therefore the strategy envisages that the implementation of the recommendations of the needs analysis be reviewed at each annual meeting of Directors to revalidate the priorities and directions in terms of current developments.

The progress of the strategy will be coordinated, monitored and assisted through SPREP's Meteorological and Climate Change Programme and the RA V Sub-Regional Office. The strategy will be an integral part of the work of the Working Group on Planning and Implementation of the World Weather Watch Programme in RA V consistent with the terms of reference of the working group (see Resolution 1 of the Twelfth Session of Regional Association V (South-West Pacific), Denpasar, 14 to 22 September 1998). The Chairman of the working group will be required to ensure that progress is reported to the Association through the President of the Association, recognising that the working group has responsibility for planning and implementation of the Public Weather Services Programme in RA V as well as its World Weather Watch responsibilities.

# 7 Existing Priorities and Program Continuity

While the needs analysis and the Action Strategy are being developed, there will be a need to maintain the momentum of support to NMSs and to focus this support on priorities in the short term. It is suggested these priorities will reflect the progress with existing on-going programs, the conclusions of the CLIPS Workshop and the recommendations of past meetings of NMSs such as SPREP Meeting of Regional Meteorological Services Directors.

# 8 Conclusion

Presented here is an action plan which has the endorsement of the Directors of the National Meteorological Services of the SPREP region. The importance of the capacity and the capabilities of the Services at all levels, national, regional and international, in meeting the many obligations and commitments of the governments of the region has been demonstrated. The success of this Action Plan will rely heavily on the full cooperation of all parties involved in the development of meteorology. In particular it will be vital that development assistance recognises the integrated regional nature of this Plan and that individual projects complement each other even though they may originate from diverse assistance programs.

# Brief Summary of the National Meteorological Services in the SPREP Region as at July 1999

| Meteorological Service | Head Office Location | Staff Numbers | | | Meteorological Stations | |
|---|---|---|---|---|---|---|
| | | Profess-ional | Tech nical | Support | Surface (RBSN) | Upper Air (RBSN) |
| American Samoa | Pago Pago | 2 | 6 | 0 | (1) | (1) |
| Australia | Melbourne | 380 | 580 | 373 | 700(128) | 50(47) |
| Cook Islands | Rarotonga | 2 | 8 | 1 | (6) | (2) |
| Federated States of Micronesia | Phonpei | 20 | 5 | 10 | (3) | (3) |
| Fiji | Nadi | 19 | 62 | 10 | (12) | 1(1) |
| French Polynesia | Papeete | 70 | 32 | 10 | 8 | (5) |
| Guam | Guam | 11 | 10 | 1 | (1) | (1) |
| Kiribati | Tarawa | 14 | 1 | 4 | (7) | (1) |
| Marshall Islands | Majuro | 7 | 1 | 2 | 0 | (1) |
| Nauru | Nauru | 2 | 1 | 2 | (1) | (1) |
| New Caledonia | Noumea | 36 | 23 | 15 | 5 | 1 |
| New Zealand | Wellington | 30 | 24 | 1 | 237(48) | 11(8) |
| Niue | Alofi | 1 | 0 | 2 | 4 | 0 |
| Northern Mariana Islands | | 0 | 0 | 0 | 0 | 0 |
| Palau | | 10 | 1 | 2 | (1) | (1) |
| Papua New Guinea | Port Moresby | n/a | n/a | n/a | n/a | n/a |
| Pitcairn Island | Pitcairn | 0 | 0 | 0 | 0 | 0 |
| Samoa | Apia | 5 | 0 | 5 | | |
| Solomon Islands | Honiara | 2 | 41 | 3 | (7) | (1) |
| Tokelau | Nukunono | 0 | 0 | 0 | 1 | 0 |
| Tonga | Nuku'alofa | 6 | 8 | 4 | (7) | (1) |
| USA (Hawaii) | Honolulu | 25 | 22 | 1 | (3) | (2) |
| Tuvalu | Funafuti | 2 | 16 | 2 | (6) | (1) |
| Vanuatu | Port Vila | 1 | 2 | 26 | (6) | (1) |
| Wallis and Futuna | | 0 | 11 | 2 | (2) | (0) |

# Appendix 2

## Extract from the Fifth WMO Long-term Plan (2000-2009) (Chapter 5 Global and Regional Priorities)

The Regional Association V attached high priority to the following issues:

(a) Natural disaster reduction through the provision of a more reliable and effective warning of tropical cyclones, monsoon depression and other extreme weather events, including associated storm surges and flash floods, technical support and advice to implement the Tropical Cyclone Operational Plan for the Region and through the organisation of workshops on public weather services in order to increase public awareness of disaster mitigation and related warnings;

(b) Development of reliable seasonal and inter-annual forecasting capability to ensure effective drought warning system and application of forecasts to water resources management, agriculture and other key socioeconomic sectors;

(c) Implementation of the Nadi Regional Specialised Meteorological Centre and the ASEAN Specialised Meteorological Centre;

(d) Assistance to and advice on the implementation of the climate monitoring network and completion of a definitive historical climate data set for the Region;

(e) Improved understanding of the nature and extent of potential threat from climate change in the Region especially with respect to the impact of the sea level rise on the low lying islands;

(f) Provision of timely and reliable advice to governments on the state of the global and regional climate on various time scales;

(g) Assistance to implement the Global Atmosphere Watch stations in Indonesia;

(h) Organisation of regional seminars and/or technical conferences on environmental issues and sustainable development;

(i) Full integration of all countries in the Region, including new and potential Members, in the work of WMO;

(j) Strengthening the collaboration with relevant regional bodies, especially SPREP, IOC-WESTPAC, ESCAP, ASEAN, the South Pacific Commission and the South Pacific Forum;

(k) Effective application of meteorological and hydrological information and knowledge to achieve sustainable development and capacity building actions in this area; and

(l) Enhanced awareness and use of assessments of climate change, its impacts and options for response strategies, especially through the IPCC and participation in the activities of the UN/FCCC.

# Appendix 3

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# Appendix 4

## List of Acronyms

ARCS - Atmospheric Radiation Cloud Station

EMWIN - Emergency Managers Weather Information Network

EU CWSUP - European Union Cyclone Warning System Upgrade Project

GCOS - Global Climate Observing System

IPCC - Intergovernmental Panel on Climate Change

NMS - National Meteorological Service

PIC - Pacific Island Countries

PICCAP - Pacific Island Climate Change Assistance Programme

RMSD - Regional Meteorological Services Directors

SBI - Subsidiary Body for Implementation

SBSTA - Subsidiary Body for Scientific and Technical Advice

SIDS - Small Island Developing States

SOPAC - South Pacific Applied Geoscience Commission

SPSLCMP - South Pacific Sea Level and Climate Monitoring Project

SDMP - Strategic Action Plan for the Development of Meteorology in the Pacific Region

SPREP - South Pacific Regional Environment Programme

UNFCCC - United Nations Framework Convention on Climate Change

US NOAA NWS - United States National Oceanographic and Atmospheric Administration National Weather Service

US DOE ARM - United States Department of Energy Atmospheric Radiation Measurement Programme

WMO RA V - World Meteorological Organization Regional Association V (South West Pacific)

WMO - World Meteorological Organization

WWW - World Weather Watch

# Appendix 5

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WMO

SPREP

US NOAA NWS

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