Theme 2
Island Vulnerability and Pacific Dialogue on Water and Climate

Sustainable Water Management in the Pacific Islands

Theme 2 Island Vulnerability and Dialogue on Water and Climate

Contents

Theme Resource Person: David Scott, Email: david.scott@chch.planet.org.nz

1 Introduction

The vulnerability of Small Island Countries has received increasing attention since 1994 when the Barbados Conference on the Sustainable Development of Small Island Developing States called for recognition of their ecological fragility and economic vulnerability. The particular vulnerability of islands is often described in terms of their remoteness, small size and exposure to climatic instability. The significance of this climatic component of vulnerability has drawn particular attention to the impacts of climate variability and change and the Association of Small Island States has been successful in gaining international recognition for those concerns.

The World Water Council has acknowledged the vulnerability and particular needs of Small Island Countries by including the "Water in Small Island Countries" theme in the 3rd World Water Forum. A Pacific Regional Consultation planning meeting held in Port Vila identified "Island Vulnerability" as a major theme that should receive particular attention and noted that this should encompass disaster preparedness and hazard management as well as the vulnerabilities associated with climate change and climate variability.

Despite broad acceptance of the special needs of Small Island Countries there has been some concern that vulnerability may have been given undue emphasis. For example, at a recent Fiji National Multi Stakeholder consultation workshop it was noted that vulnerability had become a contentious issue at UN meetings on Sustainable Development because everyone is saying they are vulnerable. Campbell (1997) suggests that the term "vulnerability should be used sparingly and that the adaptive capacity of Pacific Island communities should not be underestimated. Barnett and Adger (2001) note that the emphasis on vulnerability focuses on weaknesses and shortcomings rather than on inherent strengths and opportunities. They suggest that work should be framed in terms of resilience and emphasis should be shifted from impact assessment to risk assessment.

The Netherlands based International Secretariat of the Dialogue on Water and Climate has recognised the significance of water and climate to Small Island Countries by providing support to collaborative projects from the Pacific and Caribbean Regions which will provide further input to the 3rd World Water Forum. The Dialogue on Water and Climate implicitly recognises inherent resilience in its stated goal: "***to improve the capacity in water resources management to cope with the impacts of increasing variability of the world's climate, by establishing a platform through which policymakers and water resource managers have better access to and make better use of information generated by climatologists and meteorologists***".

2 Vulnerability in relation to water & climate

Vulnerability refers to the risk of being harmed by unforeseen, or unusual, events. There is a wide range of hazards with the potential to impact upon Water in Small Island Countries; a simple classification of these is presented in the following table.

Natural hazards	Climate (Meteorological)	Drought
		Flood
		Cyclone
		Storm surge
	Non-climate (Geological)	Volcanic
		Seismic
Human hazards		Civil unrest
		Land tenure
		Land use
		Human resources

2.1 Natural hazards - Climate

Climate (or meteorological) hazards occur over a very wide range of spatial and time scales. Nevertheless, they generally occur frequently enough in human terms to have allowed the development of traditional coping strategies. In addition, the improved scientific capability to observe and describe the interaction of the ocean and atmosphere is now providing for useful forecasts of some of these hazards.

2.1.1 Drought

Drought is an unusual hazard as, by its very nature, its onset is gradual. It has the capacity to have a broad range of impacts and as a result it can be defined and quantified in a number of different ways. White et al. (1999) list the four most common definitions of drought as:

- meteorological or climatological drought
- agricultural drought
- hydrologic data
- socio-economic drought.

The nature and severity of any particular drought episode is dependent on the duration and magnitude of the rainfall deficit. The sequence of drought impacts is felt first in systems with small water storage capacity: shallow soils may be affected by a relatively short period of below average rainfall whereas an extensive aquifer

may have sufficient storage to be little effected by a drought duration of the order of years.

Drought is one of the major natural hazards facing Pacific Island countries: when associated with an ENSO event drought can have severe impacts throughout the region. The drought impacts of the 1997-98 ENSO event have been extensively documented (Glantz, 2001). Lessons learned from Fiji's experience of that drought demonstrate the need for:

- effective and timely forecasting and warning systems
- drought-response strategies
- information on quantitative measures of drought
- awareness and education programs for drought preparedness
- improved water management
- improved crop and stock management.

The wide range of possible drought management strategies used in Pacific Island countries is presented by Falkland (2001). These include coping strategies such as used in traditional subsistence situations and measures that can be taken at the individual household level to conserve freshwater supplies and seek substitutes where possible. Reliable and timely warnings of drought would be of assistance to people who are reliant on these measures.

At a larger scale, other short-term measures are resorted to e.g. bulk cartage of water and desalination. Ideally, however, water management plans should address the inevitability of climate variability so that droughts do not necessarily require an emergency response (SOPAC, 1999). However, it should be noted that this requires adequate hydrological data for analysis and design as well as the financial resources for implementation. A WMO workshop on reviewing national capabilities for Water Resources Assessment in the South Pacific countries (Nadi, September/October 1999) indicated significant constraints. A proposal for a Pacific HYCOS project (Mosley, 2000) to address the needed capacity building is described later in this overview.

Regardless of the measures taken to safeguard the security of water supplies it is certain that other sectors such as agriculture, forestry and the environment will remain susceptible to the impacts of drought. The benefits that these sectors could gain from reliable monitoring and forecasting of drought conditions could justify the development of suitable techniques.

2.1.2 Flood

Floods are a significant hazard only in those Pacific Island countries with high islands and the hazard is greatest when these islands are within the zone affected by cyclones and the associated extreme precipitation intensities. Floods can result in loss of life and extensive property damage, especially when river floodplains have been settled and/or cultivated. In cyclone conditions the effects of floods are often exacerbated by high-intensity rain induced landslide and resulting debris which can obstruct river channels and create potentially hazardous temporary dams.

The hazards that floods present to any structure also threaten water supply infrastructure (e.g. damage to intake works, treatment plants or distribution networks). However, floods can also threaten water supplies in a less direct way by compromising water quality.

Large capital investment in structures exposed to flood hazards (e.g. bridges, dams, floodplain developments) generally requires estimates of flood magnitude of a specified probability. This sort of analysis is dependent on long-term river flow monitoring which itself is particularly susceptible to flood damage. River monitoring sites have suffered severe damage in most Pacific Island countries with flow monitoring networks, most recently to a devastating effect as a result of Typhoon Chata'an which completely destroyed or badly damaged all 11 flow monitoring sites in the Guam streamgage network.

As with the hazard of drought, it is possible to take advantage of flood warnings in some situations. Flood warning systems require near real-time data on precipitation rates and/or upstream water levels or flows. In the relatively small and steep catchments encountered in Pacific Island countries telemetry systems are likely to be necessary to provide for timely flood warnings. A flood forecasting system has been operated on the Rewa River in Fiji since the late 1980's despite the difficulties encountered in finding replacements for obsolete equipment and maintaining a telemetry capability. A flood warning system installed on the Sepik River in Papua New Guinea is no longer functional.

In most situations the practical approach to managing flood hazard is to manage the landuse in those areas subject to flooding. A perception of increasing flood hazard may result if landuse controls are poorly enforced and these areas are allowed to become informal settlements. Landuse in river catchments can also have a significant affect on flooding risk. This range of factors points to the desirability of Integrated Water Resources Management concepts to assist with hazard management.

2.1.3 Tropical Cyclone

Tropical cyclones are regarded as a serious hazard in most Pacific Island countries and their destructive power and the associated hazards of intense precipitation and storm

surge are direct threats to life and property. It is considered likely that global warming may result in an increase in cyclone wind speeds and more damaging storm surges. Climate modelling may be able to provide some indication, in a particular cyclone season, of the probability of experiencing more or fewer cyclones than normal.

These indications, though still somewhat experimental, may be helpful in reinforcing the efforts of disaster management offices to promote public awareness of cyclone response plans. However, the main focus of cyclone systems is at the near-time scale and depends upon a capacity to observe and track the spawning and evolution of individual cyclones. A network of disaster management teams exists to develop and promote suitable emergency responses. This disaster management effort is supported by the Nadi Tropical Cyclone Warning Centre in Fiji which was designated as a WMO Regional Specialized Meteorological Centre in 1995 to provide advisory services on tropical cyclone detection, monitoring and forecasting to the National Meteorological Services of the South Pacific.

Water supply systems are vulnerable to damage by cyclones and water utilities need to have appropriate risk management plans in place. Regional guidelines to risk management are referred to later in this overview.

2.2 Natural hazards – non-climate

Non-climate (or geological) hazards include volcano, earthquake, tsunami and landslide. Apart from landslide (which is often associated with cyclone conditions) these hazards have a relatively low frequency and are difficult to predict with useful reliability. From the perspective of the Island Vulnerability – Water & Climate theme these hazards are similar to cyclones in that they require development of appropriate risk management plans.

2.3 Human hazards

There is a wide range of hazards created by human activity which are capable of causing considerable harm to water resources. Some of these can be unpredictable and difficult to manage. Others are quite predictable but may require measures that are difficult to implement. Examples relevant to Pacific Island situations include:

- Civil unrest (e.g. water supplies damaged by terrorist acts)
- Land disputes (e.g. vandalism of water intakes)
- Land use (planting practices, sanitation, waste disposal)

Another category of hazard is created by what might better be called human activity where a lack of resources creates a risk. Examples include:

- Inadequate human resources or technical capacity (e.g. loss of trained personnel may compromise delivery of a critical service)

- Inadequate information may limit investment in water resources development or expose projects to poorly understood risks
- Budgetary limitations (e.g. communications disrupted though lack of financial resources)
- Institutional (e.g. lack of legislative or administrative control.

Finally, it is worth noting the point made by Campbell (1997) that the emphasis given to vulnerability in climate change research is conducive to a loss of confidence as it focuses on weaknesses and shortcomings rather than inherent strengths and opportunities. Barnett & Adger (2001) suggest that that can be countered by framing such research in terms of resilience rather than vulnerability. They argue that there should be a shift of emphasis from impact assessment to risk assessment with explicit quantification of uncertainties.

3 Responding to hazards

The terms coping and adaptation are often used to describe alternative types of response to hazards. Coping tends to be used in the sense of "coping with" and may imply a reactive approach whereas adaptation tends to be expressed as "adapting to" implying a more proactive approach. These distinctions are, to some extent, rather arbitrary and there is considerable overlap between the two terms. An alternative classification can be based on consideration of whether or not the response is based on a forecast. The following examples of systematic responses to hazards illustrate both types of approach. They are chosen to represent the broad range of responses at a strategic level. It is expected that other responses emerging from the National Consultations will be discussed at the Regional Consultation meting and included in the final overview report.

3.1 Application of seasonal and inter-annual climate forecasts

Research into the interaction of the ocean and atmospheric over the last two decades has resulted in an impressive ability to observe and account for many of the factors governing climatic variability at the seasonal and inter-annual time scale. This has led to the development of techniques that are able to produce climate forecasts of modest skill (Ropelewski and Lyon, 2002?). A number of initiatives are underway within the Pacific region to provide useful information from the available forecasts to support decision makers:

- The Pacific ENSO Applications Center (PEAC), which was established in 1994 to conduct research and produce information on climate variability for the U.S. affiliated Pacific Islands, produces a quarterly bulletin (the Pacific ENSO Update) providing a summary of conditions, forecasts and local variability summaries (http://lumahai.soest.hawaii.edu/Enso/subdir/update.dir/update.html). PEAC has taken an active role in disseminating critical climate forecasts to decision makers, an activity that has depended upon good understanding of local climate variability and how it relates to larger scale climate cycles. PEAC's role in warning governments in the U.S. affiliated Pacific Islands of the expected impacts of the 1997-98 El Niño contributed to the interest in developing a similar capability in the South Pacific.
- In response to a recommendation made at the Sixth SPREP Meeting of Regional Meteorological Services Directors the Australian Bureau of Meteorology collates and disseminates a South Pacific Seasonal Outlook Reference Manual. This document is directed at National Meteorological Services and provides a summary of current observations and seasonal and long-range forecasts of sea surface temperatures and rainfall.
- The National Institute of Water and Atmospheric Research, New Zealand (NIWA) publishes a monthly climate bulletin for the Pacific region which provides an overview of the present climate with an outlook for the coming three months. The Island Climate Update (ICU), which is distributed in hard copy and made available on the web at http://www.niwa.cri.nz/NCC/ICU, is designed

to be useful to users of climate data as well as to National Meteorological Services.

From the perspective of water resources management the principal interest in long-term climate forecasts is their potential to provide early warning of the onset, severity and persistence of the precipitation anomalies leading to drought conditions. The SOPAC workshop on ENSO Impact on Water Resources in the Pacific Region (SOPAC, 1999) demonstrated the growing demand from users of climate information for seasonal and inter-annual forecasts. However, as Stern and Easterling (1999) note "the effectiveness of forecast information depends strongly on the systems that distribute the information, the channels of distribution, recipients' modes of understanding and judgement about the information sources, and the way in which the information is presented". They reinforce PEAC's conclusions regarding the significance of local knowledge by suggesting that forecasts will be most effective when "organised to meet recipients' needs in terms of their coping strategies, cultural traits and specific situations; that participatory strategies are likely to be most useful in designing effective climate forecast information systems".

These requirements place demands on the users of climate information (water resource managers, disaster managers) as well as the developers and distributors of forecasts. Without an adequate appreciation of the nature of a forecast and an effective response strategy it is likely that timely warnings will go unheeded. For example, Glantz (2001) records that in May 1977 the Fiji Meteorological Service provided a drought forecast that gained little response from users. He suggests that this was most probably because of the difficulties of using information presented in meteorological terms. However, it is also likely that a lack of effective response strategies would also have played a role. Lessons have been learnt from that experience but as illustrated in the Fiji Case Study "Rainfall Forecasting and its Applications" further efforts are required.

Such needs are widespread. In a review of Regional Climate Outlook Forums IRI (2001) reported for the Caribbean, Pacific Islands and Southeast Asia that "capacity is needed to develop and enhance the application of climate information. Currently, climate information users include disaster managers, hydrologists and water managers, and, in the case of Southeast Asia, environment ministries. Pilot projects and workshops are needed to develop better understanding of user needs and to develop an understanding of the value of climate forecasts and information in agriculture, water resource management, health and other sectors."

3.2 Hazard and risk management programmes

The recognition that vulnerabilities should be addressed by risk management has been reflected in two guidelines recently developed by SOPAC:

- Guidelines for water and sanitation utilities risk management planning (Mearns and Overmars, 2000?) provides a framework for identifying and analysing the hazards to utilities and promotes the development of specific plan required to

prepare for, mitigate and respond to disasters. The Regional Consultation meeting will provide an opportunity for feedback on the implementation of these guidelines.

- A more comprehensive set of guidelines for Comprehensive Hazard and Risk Management (CHARM) has been developed as part of the SOPAC Disaster Management Unit's work programme. CHARM is defined as a comprehensive hazard and risk management tool and/or process within the context of an integrated national development planning process. It is expected that these guidelines will be outlined in one of the case studies to be presented during the Island Vulnerability theme session.

3.3 Vulnerability and adaptation assessments in relation to climate variability and change

Vulnerability and adaptation assessments in relation to climate change are required of signatory countries to the United Nations Framework Convention on Climate Change (UNFCC). The Pacific Islands Climate Change Assistance Programme (PICAPP) was developed to assist with the reporting, training and capacity building required under the convention. Climate Change Country Teams established under PICAPP undertook to:

- prepare inventories of greenhouse gas sources and sinks,
- identify and evaluate emission reduction strategies
- assess vulnerability to climate change
- develop adaptation options
- develop a national implementation strategy for mitigating and adapting to climate change over the long term.

Ten Pacific Island Countries have concluded preliminary national vulnerability assessments. In a synthesis of these assessments Hay and Sem (2000) note the following adaptations with relevance to water resources:

Improved management and maintenance of existing water supply systems has been identified as a high priority response, due to the relatively low costs associated with reducing system losses and improving water quality.

Centralised water treatment to improve water quality is considered viable for most urban centres but at the village level it is argued that more cost-effective measures need to be developed.

User pay systems may have to be more widespread.

Catchment protection and conservation are also considered to be relatively low cost measures that would help ensure that supplies are maintained during adverse conditions. Such measures would have wider environmental benefits, such as reduced erosion and soil loss and maintenance of biodiversity and land productivity.

Drought and flood preparedness strategies should be developed, as appropriate, including identification of responsibilities for pre-defined actions.

While increasing water storage capacity through the increased use of water tanks and/or the construction of small-scale dams is acknowledged to be expensive, the added security in the supply of water may well justify such expenditure.

Development of runways and other impermeable surfaces as a water catchment is seen as possible, but an extreme measure in most instances. Priority should be given to collecting water from the roofs of buildings.

Measures to protect ground-water resources need to be evaluated and adopted, including those that limit pollution and the potential for salt-water intrusion.

The limited ground-water resources that are as yet unutilised in the outer islands of many countries could be investigated and, where appropriate, measures implemented for their protection, enhancement and sustainable use.

The development of desalination facilities is considered to be an option for supplementing water supplies during times of drought, but in most instances the high costs are seen as preventing this being considered as a widespread adaptation option.

Amongst the many assessment findings summarised by Hay (2002) the following are most relevant to the Island Vulnerability – Water & Climate theme:

?? climate variability, development and social changes and the rapid population growth being experienced by most PICs are already placing pressure on sensitive environmental and human systems; and these impacts would be exacerbated if the anticipated changes in climate and sea level (including extreme events) did materialise;

?? land use changes, including settlement and use of marginal lands for agriculture, are decreasing the natural resilience of environmental systems and hence their ability to accommodate the added stresses arising from changes in climate and sea level;

?? given the limited area and low elevation of the inhabitable lands the most direct and severe effects of climate and sea level changes will be increasing risks of coastal erosion, flooding and inundation; these effects are exacerbated by the combination of seasonal storms, high tides and storm surges;

?? other direct consequences of anticipated climate and sea level changes will likely include: reduction in subsistence and commercial agriculture production of such crops as taro and coconut; decreased security of potable and other water supplies; increased risk of dengue fever, malaria, cholera and diarrhoeal diseases; and decreased human comfort, especially in houses constructed in western style and materials;

?? groundwater resources of the lowlands of high islands and atolls may be affected by flooding and inundation from sea level rise; water catchments of smaller, low-lying islands will be at risk from any changes in frequency of extreme events;

?? the overall impacts of changes in climate and sea level will likely be cumulative and determined by the interactions and synergies between the stresses and their effects; and

?? the current lack of detailed regional and national information on climate and sea level changes, including changes in variability and extremes resulted in most assessments being limited to using current knowledge to answer "what if" questions regarding environmental and human responses to possible stresses.

The first of these findings is particularly significant since it implies that in most parts of the Pacific region present problems resulting from increasing demand for water and increasing pollution of water may be much more significant that the anticipated affects of climate change.

The final listed finding is also significant in that it refers to climate variability. The UNFCC reporting obligations referred specifically to climate change (rather than to climate variability and change) possibly reflecting the perspective of climate change science current at the time the convention was drafted. A greater appreciation of the role of variability has developed and it is now generally recognised that the impacts of climate change are likely to be experienced through changes in variability has been realised. These considerations suggest that managing water resources for variability and extremes is fundamental to the issue of adapting to climate change in the longer term.

4 Identification of priority actions

Identification of priority actions relevant to Island Vulnerability and Water and Climate will emerge from individual National Consultations and subsequent discussions at the Regional Consultation meeting. Recommendation for action emerging from the Bonn Conference include several which are relevant to the Island Vulnerability theme and these are listed below. In addition, there are existing proposals for capacity development in relation to water resources assessment and climate information and prediction which the meeting may choose to endorse and these are outlined below. Several other possible actions are listed for discussion. Comments on these plus any other suggestions will be included in the final draft after the consultation at the Regional Meeting.

4.1 Recommendations for Action from Bonn Conference

The International Conference on Freshwater (Water – A key to sustainable development) held in Bonn in 2001, adopted a comprehensive set of recommendations for action (http://www.water-2001.de/outcome/BonnRecommendations/Bonn_Recommendations.pdf). Many of these are relevant to several of the themes included in the Pacific Regional Consultation. Those most relevant to Island Vulnerability and Water and Climate are listed below:

?? Water management arrangements should take account of climate variability and expand the capacity to identify trends, manage risks and adapt to hazards such as floods and droughts. Anticipation and prevention are more effective and less expensive than having to react to emergencies. Early warning systems should become an integral part of water resources development and planning.

?? Knowledge is the foundation of understanding and decision -making. Shared knowledge, and respect for different forms of knowledge, are the basis for building consensus and resolving conflicts. Decisions can only lead to effective management actions if the actors have the right knowledge and skills. Enhancing human capacities at all levels is a key for wise water management. This needs to be based on integrating the distinct and complementary contributions of local, traditional knowledge, knowledge from different professionals and disciplines and the hands-on experience of practitioners. All can and should learn from each other. Practical actions to build partnerships and create channels for sharing information at all levels are a key first step in developing integrated water management.

?? The knowledge and skills needed for water management change as new knowledge is generated and new needs emerge. Mechanisms to disseminate knowledge, change curricula, exchange teaching materials and create partnerships between educators and trainers around the world should be developed and funded.

?? Knowledge must be shared globally and packaged appropriately for in-tended target audiences. This includes the provision by all countries of basic data for research and

assessment. Information management must provide information to decision makers at the right time and in a form they understand.

?? Capacity building and technical assistance are among the essential elements for institutional change for integrated water management. This is a long-term process, which should be based on gradual, practical steps. It must be flexible, as needs are constantly changing. Collaboration and international partnerships are particularly needed in many developing countries, where reform is most needed but resources are most limited.

?? There are many positive experiences of institutional change throughout the developing world. Specific initiatives to develop models of good practice and improve South-South sharing of experiences are needed.

?? The wealth of available experience in all countries and sectors needs to be tapped in a systematic fashion. Donor agencies and industry need to cooperate for the transfer and adaptation of the best available technologies. South-South technical transfer is also important.

4.2 Pacific HYCOS

The development of a Hydrological Cycle Observing System for the South-West Pacific region (Pacific HYCOS) was considered at a meeting of experts on "Hydrological Needs of Small Islands" held in Nadi, Fiji in October 1999. A project proposal, developed in collaboration with the countries and in consultation with Regional organizations, was circulated in February 2001 to the countries concerned in the region. The project has been endorsed for implementation by eight countries and territories (Cook Islands, Fiji, Nauru, New Caledonia, Niue, Papua New Guinea, Solomon Islands and Vanuatu).

The Pacific HYCOS has been developed on the basis of a detailed needs analysis and has a strong emphasis regionally coordinated capacity building. The stated purposes of the project are:

- ?? To assist the participating countries to establish the human and institutional capacity to assess status and trend of national water resources and to provide adequate warnings of water-related hazards.
- ?? To establish basic hydrological monitoring and data capture systems, using technology that balances modernity, economy, robustness, and suitability for Pacific Island circumstances.
- ?? To establish hydrological databases and information systems that provide users with the information they require, to the standards they need, and that provide a secure repository of information for the indefinite future.

The project proposes to deliver six distinct components which are designed to meet the range of needs of Pacific Island countries as follows:

?? Flood forecasting capability,

?? Water resources assessment in major rivers,

?? Water resources databases,

?? Drought forecasting,

?? Groundwater monitoring and assessment, and

?? Water quality monitoring and assessment.

This project addresses one of the critical areas relevant to Island Vulnerability and in recognition of this a working group will be constituted during the Regional Consultation meeting with the objective of formulating an endorsement for consideration to be included in the meeting declaration.

4.3 Pacific Climate Information and Prediction System

The potential for a regional approach to the provision of climate information and predictions has been recognised for several years. Basher (1997) developed a comprehensive proposal to build Pacific Island countries' capacity for management and application of climate data with multiple objectives including support for the application of climate forecasting in the region. Though that proposal failed to gain support, interest in the potential for climate systems has continued to grow and an Informal Working Group on a Pacific Climate Information and Prediction System was organised under the auspices of SPREP in 1999. At its initial meeting the group adopted the goal "to combine the unique assets and special expertise of a number of national, regional and international institutions and programs to develop and strengthen a Pacific Climate Information and Prediction System designed to support practical decision making in the context of climate variability and change".

The experience of the 1997-98 El Niño developed much broader appreciation of the value of climate information and forecasting and a Regional workshop on ENSO impacts on water resources (SOPAC, 1999) called for the development of appropriate programmes to deliver climate information and forecast services. The meeting, which was attended by representatives from 23 Pacific Island countries with backgrounds in water resources management, disaster management and meteorological services, highlighted the need for more interaction between national agencies and urged WMO and SPREP to work closely with SOPAC and the Pacific ENSO Applications Centre (PEAC).

The concept of a regional climate system gained some support, initially from the Italian Government and subsequently from NZODA, which has provided for the production of The Island Climate Update. This climate bulletin is produced by NIWA (National Institute of Water and Atmospheric Research, New Zealand) and provides an overview of present climate in the tropical South Pacific with an outlook for coming months

(http://www.niwa.cri.nz/NCC/ICU). The possibility of sustaining and developing this service received attention at the recent meeting of the WMO Regional Association for South-West Pacific (RA V) which recorded support for the establishment of Regional Climate Centres in the region. Development of a Pacific Climate Information and Prediction System may be promoted by its adoption as a priority action by the Pacific Regional Consultation meeting. It should be noted that this is likely to require the close collaboration of SPREP and SOPAC.

4.4 Drought assessment and response

A drought forecasting capability is one of the components of the Pacific HYCOS. Nevertheless, if that project does not proceed or is delayed, it would be quite feasible to undertake an independent project to implement procedures to monitor and forecast drought in Pacific Island countries. Relevant preliminary work has already been undertaken in a case study of Tarawa Atoll, Kiribati (White et al., 1999). The potential value of developing procedures and extending their application to other island countries was recognised at the ENSO workshop in Fiji (SOPAC, 1999) and a draft project proposal has been prepared.

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