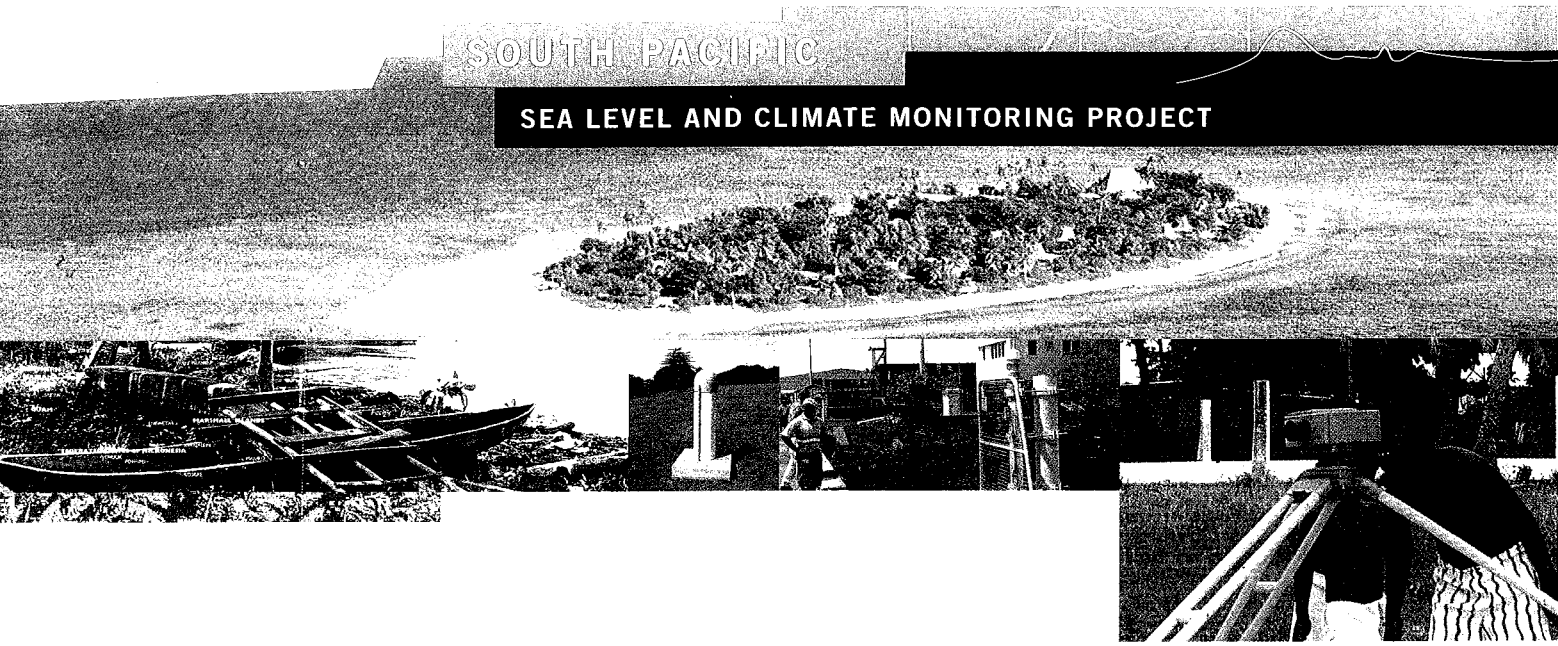
JULY 2002

SOUTH PACIFIC SEA LEVEL AND CLIMATE MONITORING PROJECT



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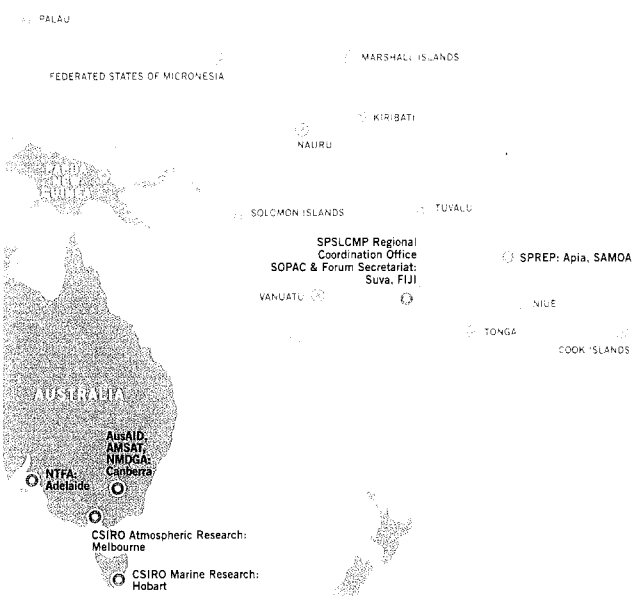
INTRODUCTION

As many readers will know, the South Pacific Sea Level and Climate Monitoring Project was initially developed in the early 1990's as a response to concerns about the potential impacts of global warming on climate and sea levels in the Pacific. The AusAID funded project was established with the goal of providing an accurate, long term record of sea levels in the South Pacific both for partner countries and for the international scientific community which need such information to better understand how the Pacific oceanographic and meteorological environment is changing. That, in turn, will assist governments and ultimately communities to respond to and adapt to both short term and long term change, and better manage any likely impacts. 14 Pacific Island countries are involved in the monitoring of sea level and related phenomena.



MONITORING SEA LEVEL TRENDS— A DECADE OF EXCELLENCE

Nearly a decade has passed since the first SEAFRAME station was commissioned at Lautoka, Fiji, in October, 1992. Since then, the Lautoka gauge has been joined by eleven others, and the array has been widely acknowledged in the climate science community as one of the most accurate and reliable sources of information on sea level and climate change. As the ten-year mark approaches, it is appropriate that we take stock of our progress in the most fundamental goal of the Pacific Project – establishing the rate at which sea level is changing in the Pacific region.

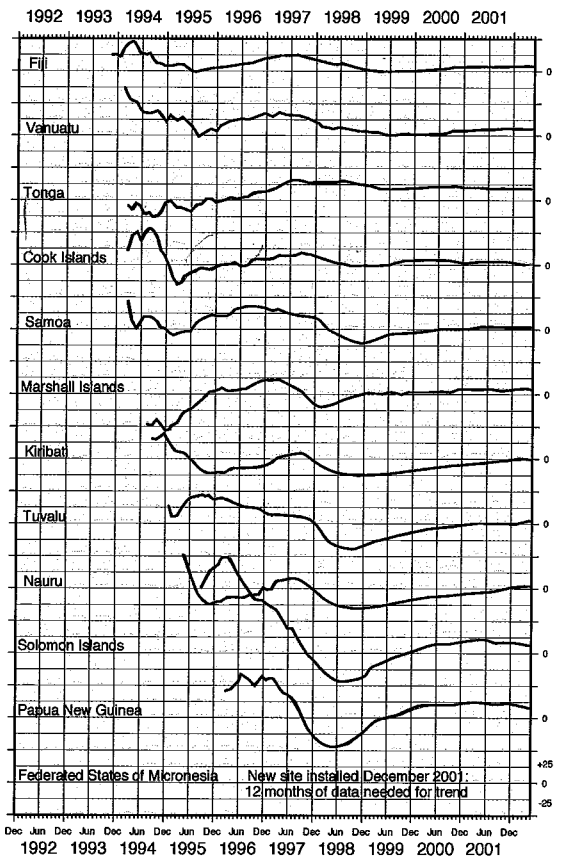
The National Tidal Facility Australia recognised early on that improvements would be required not only to the unreliable and inaccurate instrumentation that had served as port tide gauges in the past, which led to the adoption of the acoustic technology developed by NOAA (an agency of the US government), but also to the way in which emerging trends were teased out of the sea level data. Work commenced on a new algorithm which led to the development of the technique known as "Asymptotic Trend Evaluation", or ATE. In this article, we will use the ATE results to describe current sea level trends in the Pacific.

Recent short-term sea level trends in the project area based on SEAFRAME Data (through May, 2002)

Location	Length of data (in months)	Trend (mm/yr)
Cook Is.	110	+1.9
Tonga	111	+18.6
Fiji	115	+7.5
Vanuatu	101	+11.1
Samoa	110	+3.7
Tuvalu	108	+3.1
Kirabati	108	+0.1
Nauru	105	+3.6
Solomon Is.	90	+13.3
PNG	77	+17.3
FSM	5	na
Marshall Is.	103	+8.0

The Table above summarises the ATE results for sea level. What does it tell us? First of all, it is interesting that the trend everywhere is positive, even though there is a wide variation—from +0.1 to +18.6 millimetres per year. This may be compared with recent estimates from tide gauges (that have been in operation around the world since earlier in the century) that show a sea-level rise of about +1 to +2 mm/year. We know that much more time will be required before the Pacific Project gauges have been in operation long enough to truly "zoom in" on the real trend, because of the degree of natural variability that is in sea level. Perhaps the best way to see how this works is to examine the ATE plot below.

Sea level trends through May 2002 in mm/year.



The ATE plot shows how the trend estimates gradually "settle down" to a constant, or nearly-constant, value. During the first few years of operation the trend estimates fluctuate wildly. For example, if someone had computed the trend at Papua New Guinea (Manus Island) in 1996, after only two years of data, they may have been deceived into thinking the sea was rising at a rate of over half a metre per year! But then two years later, in 1998, they would have been led to the opposite conclusion. In the past two years, the curve has flattened out to a value which is still higher than most, but coming to "within the ballpark".

The Papua New Guinea station is very much affected by El Niño. Further from the equator, the El Niño changes are less severe. At Tonga and the Cook Islands, the curve began flattening out far more quickly, and now (as the Table tells us) the data from these stations show overall trends, since installation, of +18.6 and +1.9 mm/year respectively. This brings up another question—why are these two so different? After all, they are relatively close to each other, and have been showing fairly consistently the same result for several years now. The explanation for this is quite simple. Sometime around 1996, the SEAFRAME instrument moved downwards by more than eight millimetres, possibly due to a collision between a boat and the wharf when this vertical shift is accounted for, the net trend is closer to that of the Cook Islands. This also serves to highlight the importance of the regular geodetic surveys undertaken as part of project activities.

It is important to stress that as the sea level record becomes longer, the short-term trend estimate becomes more stable and reliable. Observed trends in sea level include natural variability, for example, events such as El Niño and effects due to many other atmospheric, oceanographic and geological processes. Longer-term data sets for all stations are required in order to separate the effects of the different signals. So, please exercise caution in interpreting these trends—they will almost certainly change over the coming years as the data set increases in length. For example, the positive trends at PNG and the Solomon Islands are likely to decrease as sea levels drop when the next El Niño phase is entered into.

To summarise, we have seen that the Pacific Project tide gauges are already starting to show hints of their original promise of accuracy and reliability. Once the survey data is accounted for, the trends are approaching realistic values, which may be reassuring against a backdrop of widely varying predictions. However, even a rise of 2 mm/year accrues over time and rise, even without including the impact of accelerating rates of sea level rise, which some predict.

PROJECT PHASE III

We are now in the 3rd Phase of the project and over its 5 years will be concentrating on building on and extending the work of earlier phases which has established the infrastructure and systems critical to achieving the objectives of the project.

What is often forgotten is that to be able to provide information of any real value to those people who have to make serious resource and environmental management decisions an adequate information base must be developed. Decisions based on incomplete or inconclusive data will inevitably be questioned in the long term. But this is not to say that after 10 years of work the project can provide all of the answers to questions about the impacts of climate change in the Pacific on sea levels, or the frequency of cyclones or storm surges. The project has however begun to develop some very important data sets which can make a significant contribution to the regional and international efforts underway to better understand and plan for these changes. And the project will continue to collect and analyse sea level and climate data over the 5 years of this phase to better improve the detail of information provided to politicians, policy makers and the general public.

So Phase III, which will continue until the end of 2005, will be concentrating on:

- providing a range of data and information on climate change and variability related issues to stakeholders around the region. The audience for such information is very broad, from politicians to school children, from scientists to fishermen. The project will be providing and distributing a variety of materials including newsletters such as this and:
    - posters
    - fact sheets
    - tidal calendars
    - data reports and
    - scientific reports
- utilising the internet to improve access to all project information via the project web site www.pacificsealevel.org
- providing a broad range of training to PIC and Regional Organisation counterparts covering:
    - equipment installation and management
    - data management and exchange
    - applications of project information in management

- providing 4 post graduate scholarships to PIC counterparts to attend Australian universities and work with Australia counterpart science agencies in using project data and information.
- encouraging increased interaction between scientists and environmental and resource managers so as to ensure that project information is used to best advantage and so that each group has a better appreciation of the others needs.
- establishing a network of Continuous Global Positioning System (CGPS) stations close to existing Seaframe facilities to monitor movement in the Earth's crust so as to help determine absolute sea level change.

KEY PLAYERS

The total success of the project, particularly in providing the information and training required to enable PIC governments to derive maximum benefit from the project and to play a more significant role in both technical and management activities in the longer term, requires collaboration between a number of key organisations. These Australian and Regional Organisations are all working closely together to ensure the quality of project outputs.

AusAID

Australia is one of the leading development assistance donors to the Pacific region. The Australian Agency for International Development, AusAID, is responsible for the management of the official Australian Government overseas aid program and provides administration and funding for the South Pacific Sea Level and Climate Monitoring Project as part of its broad portfolio of regional and bilateral environmental management programs.
http://www.ausaid.gov.au

AMSAT

Australian Marine Science and Technology Ltd (AMSAT) an environmental project management company, is the managing contractor for Phase III. AMSAT is responsible for the management and delivery of all project outputs, including organisation of specialist technical services, data management, information distribution and the provision of training.
http://www.amsat.com.au

GEOSCIENCE AUSTRALIA

Formerly the Australian Surveying and Land Information Group, or AUSLIG, the National Mapping Division of Geoscience Australia is the national agency for spatial information. NMDGA is responsible for the establishment of the CGPS network and collection and analysis of the data produced by it.
http://www.auslig.gov.au

CSIRO

The Commonwealth Scientific and Industrial Research Organisation, CSIRO, is Australia's principal scientific research body. CSIRO Atmospheric Research conducts research into weather, climate and atmospheric pollution. In conjunction with Global Environmental Modelling Systems, GEMS, CSIRO will be evaluating the risk of cyclone-induced storm surge and inundation for several locations within the South Pacific and producing computer models for use in developing mitigation strategies.
http://www.dar.csiro.au

CSIRO

CSIRO Marine Research conducts research into the sustainable use of marine resources, the ocean's role in climate and the effective conservation of the marine ecosystem integrity. In Phase III of the project, CSIRO Marine Research will be involved in modelling extreme events such as storm surges and in preparing scientific papers and reports based on the data generated by the project.
http://www.marine.csiro.au

The National Tidal Facility, Australia, part of the Flinders University of South Australia specialises in tidal predictions and sea level monitoring. NTF has played a key technical role in the project since its inception having established the Seaframe network and managed Phases I and 2 of the project. NTFA manages the Seaframe data and takes primary carriage for the production of sea level related information. **http://www.ntf.flinders.edu.au**

The Pacific Island Forum represents Heads of Government of all the independent and self-governing Pacific Island countries, and Australia and New Zealand. A key counterpart organisation, the Forum Secretariat in Suva helps develop economic and political responses for the region and its people.
http://www.forumsec.org.fj

The South Pacific Applied Geosciences Commission, SOPAC, is an independent, inter-governmental regional organisation established by South Pacific nations in 1972. Based in Suva, SOPAC carries out research into coastal processes and oceanography, freshwater resource management, hazard and vulnerability assessment, database and information management. The regional data archive for the project is being established at SOPAC and SOPAC provides technical counterpart support to the project.
http://www.sopac.org.fj

The South Pacific Regional Environment Program, SPREP, is a regional organisation established by Pacific region governments and administrations to look after their environment. SPREP's headquarters in Apia direct the development of environmental management strategies in response to global environmental change and variability. SPREP distributes information and advice to environmental managers throughout the region.
http://www.sprep.org.ws

DATA ARCHIVING AND AVAILABILITY

At present, Seaframe data and CGPS data are transmitted to NTFA, Adelaide and NMDGA Canberra respectively, where they are validated, quality assured and archived for analysis and research.

The archived data sets are circulated on a quarterly basis to counterpart agencies and are available more broadly via the project web site at "Tides" and "CGPS Data".

Seaframe data is also archived at the University of Hawaii Sea Level Centre.

As part of the Phase III project, a replicate regional data archive (RDA) is being established at SOPAC in Suva. Some minor equipment upgrade is being done at present and we expect that access to all data will be available via the RDA in early August.

Mr. Les Allinson, the Information Technology Manager at SOPAC, will be the first point of contact for the RDA.

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Email: les@sopac.org
www.sopac.org

Establishment of the RDA is one of the elements of the increased regionalisation of the SPSLCMP during this phase.

RECENT ACTIVITIES

ONGOING ACTIVITIES

Since Phase III began in early 2001 there has been a good deal of "business as usual" in that the nature of environmental monitoring does mean that sticking to routine is very important. So the regular Seaframe equipment calibration and maintenance missions and precise levelling survey missions have continued on their 18 month site rotation cycles and, in the main, there have not been significant problems encountered.

One of our SOPAC technical counterparts, Andrick Lal, joined the NTFA survey team in August 2001 and is proving to be a very well qualified and valuable team member. We'll have a profile of Andrick in the next issue of this newsletter.

CGPS

The most important new initiative of this phase, the establishment of the CGPS network, commenced in mid 2001 and to date six of the stations have been installed and commissioned at:

- Apia, Samoa
- Rarotonga, Cook Islands
- Funafuti, Tuvalu
- Lautoka, Fiji
- Nuku'alofa, Tonga, and
- Manus Island, PNG

In all cases our CGPS team of Bob Twilley and Steve Yates from NMDGA have been given great assistance from our counterpart PIC Lands and Survey agencies which has enabled the difficult logistics of construction and establishment to be completed in a remarkably short timeframe.

Reconnaissance visits to future sites have also been undertaken and new facilities will now be established in Kiribati, Nauru and Vanuatu. The balance of sites will be completed over the next 12 months.

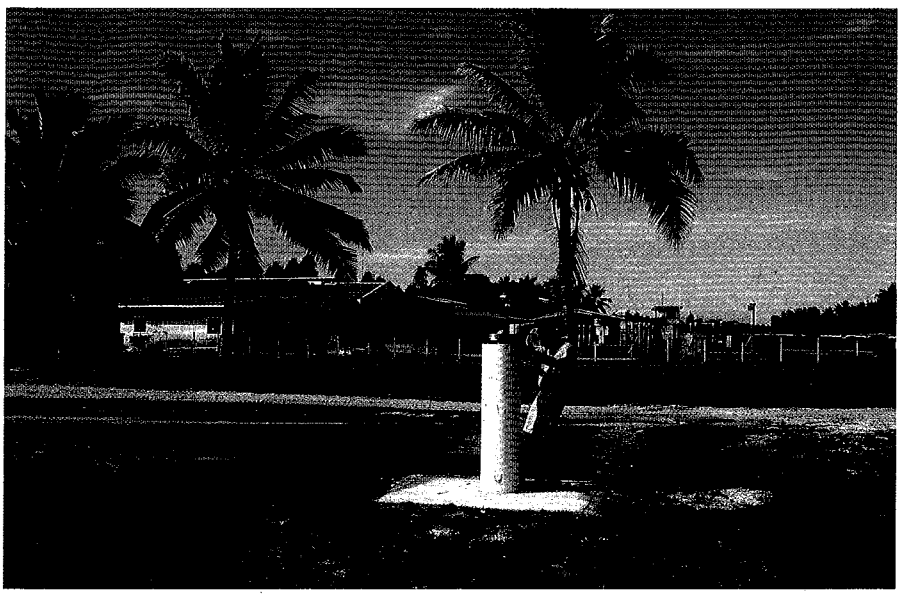
CGPS data is flowing without problems and can be accessed via the web site. As the first 12 months of data will soon be available from the Apia facility, the first of the CGPS Monthly Data Reports will become available.

REGIONAL OFFICE

Essential to the success of improved project regionalisation has been the establishment of the Regional Coordinator's office in Suva.

Located in office space of the Forum Secretariat headquarters, the office is presently home to Dr. Chalapan Kaluwin, who will shortly be joined by an assistant.

The office will be the focal point for engagement with PIC's and counterpart Regional Organisations, for distributing information materials and for coordinating and managing regional field work and training activities. The office contact details are on the final page of this newsletter.



The installation at Tuvalu, opened 1st December 2001

AUSTRALIAN GOVERNMENT ANNOUNCES EXTRA FUNDING TO ADDRESS CLIMATE CHANGE IMPACTS

At the CHOGM meeting in March 2002, the Australian Minister for Foreign Affairs, Mr Alexander Downer, announced three significant initiatives targeted at the natural resource sector. This included the allocation of A$4 million over seven years to assist countries vulnerable to the adverse impacts of climate change and climate variability.

The funding will complement current Australian development assistance activities (including SPSLCMP) and will be coordinated closely with other donor funded programs in the Pacific. Activities to receive funding will include vulnerability assessment studies, pilot projects dealing with the impacts of climate variability and change and regional consultations on island adaptation requirements.

Some of the attendees at the March PCC and workshop

FIRST PROJECT COORDINATION COMMITTEE MEETING, SUVA

The first Project Coordination Committee meeting was held in March 2002 at FORSEC headquarters in Suva. Ms Sue Erbacher, Program Manager for Environment, South Pacific Regional Section, AusAID chaired the meeting, which was attended by representatives from four PIC's and several Regional Organisations. The meeting devoted the majority of its discussions to reviewing progress to date and considering project implementation over the coming twelve months with particular attention given to information exchange and training.

The meeting was preceded by a half day seminar which discussed the outcomes of recent monitoring work and the expected directions and technical outputs of the project over the coming months. Copies of the presentations by Mr. Bill Mitchell (NTFA), Dr. Ramesh Govind (NMDGA) and Dr. Graeme Hubbert (GEMS) are available on the project web site.

Regional Coordinator, Chalapan Kaluwin, presenting at the PCC seminar

During the course of the PCC, AMSAT and SOPAC concluded a Letter of Agreement relating to SOPAC's support for the project particularly in relation to counterpart technical support for NTFA and NMGA field teams and for the establishment and management of the project's Regional Data Archive.

The next meeting of the PCC is tentatively scheduled for May 2003.

SOPAC's Deputy Director, Russell Howorth & AMSAT's CEO, Robert Harriss, concluded a Letter of Agreement during the PCC meeting.

EXPERT MISSION TO TUVALU

One particular issue reported on at the PCC related to recent incidents of flooding and sea water intrusion on Funafuti and near islands which were causing significant concern to the people of Tuvalu.

The representative of Tuvalu to the PCC, Ms Hilia Vavae requested project assistance to assess the likely extent of flooding and impacts to tidal erosion on Funafuti's infrastructure. The request echoed a similar concern conveyed to the Secretary-General of the Forum and the project was able to mobilize two of its specialists, Dr. Wolfgang Scherer, Director of NTFA and Dr. Chalapan Kaluwin, Regional Coordinator to visit Tuvalu in late March.

The objectives of the mission were to:

(i) Provide a technical presentation to Government of Tuvalu representatives on the science of climate variability and change, and sea level change at a regional level and Tuvalu's situation specifically, using the observed data from the South Pacific Sea Level and Climate Monitoring Project since 1991.

(ii) Conduct a field trip in Funafuti and its Islands to assess and report on the vulnerable sites impacted by climate variability and sea level changes, especially by flooding and tidal effects; and

(iii) Provide a report on the mission and its findings to the Government of Tuvalu, to the Secretary-General of the Forum and to AusAID.

A full report has been finalised and notes particularly:

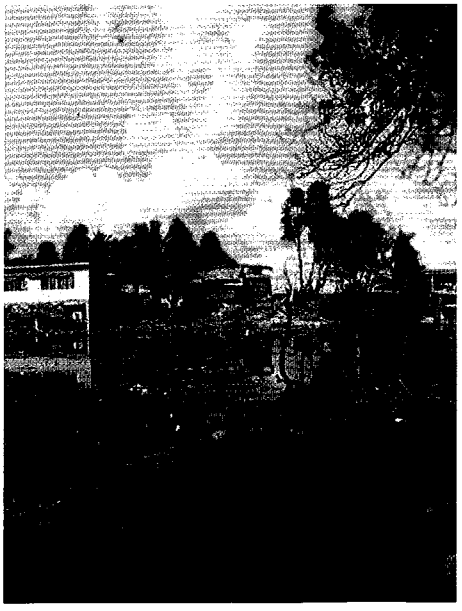
- King tides in February and March each year cause damage to the water lens, agricultural crops and activities and flooding in homes.
- Erosion and recent flooding causes some concerns to homes by the beach.
- Important sand supplies were lost due to ocean currents and flooding in the islands.
- Certain parts of the islands are below extreme tidal ranges.
- Ground water was brackish or saline with possible contamination by human activities.
- Coastal protection is encouraged and exists on the island of Funafuti.
- Pulaka and Taro pits need more attention and better agriculture management.
- Flooding increased water level in sites of borrow pits indirectly causing waste problems in these areas.
- New airport infrastructure and runway is an excellent catchment area for water management and conservation for agricultural applications and drinking supply; and
- Increased awareness and training to understand climate change and sea level rise issues is important for government officials and other stakeholders in the island communities.

Typical beach erosion on the island

The mission was by necessity a brief one but did confirm that issues in relation to coastal management are significant and will require attention in the immediate future.

The project team was also able to assist the Government of Tuvalu representatives with whom they met to define priority project activities which could be discussed with potential sources of technical assistance.

Flooding of ancestors grave



Flooding in Borrow pits

UPCOMING EVENTS

The coming six months will be particularly important for project implementation.

Information and Training Working Group (ITWG)
The project's Information and Training Working Group (ITWG) will be meeting in early July to discuss the scope for collaborative activities in information exchange and in training program development and delivery between the project and key counterpart Regional Organisations including USP, SOPAC, SPREP and FORSEC.

Australian Ambassador for the Environment, Dr. Chris Langman on visits
The Regional Coordinator and NMDGA staff are expecting to accompany the newly appointed Australian Ambassador for the Environment, Dr. Chris Langman on visits to Tuvalu and Kiribati in late July/early August.

Forum Leaders meeting
Presentations will be made to the forthcoming Forum Leaders meeting in Suva in August by the Director of the NTFA, Dr. Wolfgang Scherer and the Regional Coordinator as part of the program to enhance the profile of the project to key regional leaders. In a similar vein, the project will be represented at the SPREP and SOPAC Governing Council meetings in July and October respectively.

CGPS facilities
CGPS facilities will be commissioned in Kiribati (July), Vanuatu (September) and Nauru (November) with reconnaissance missions also planned to Marshall Islands, Federated States of Micronesia and Solomon Islands later in the year.

Computer upgrades
Computer upgrades for counterpart meteorological agencies will be put in train over the period July—October and the first round of targeted formal training programs will also be initiated.

Modelling products
The first of the project's modelling products are also expected to become available over the next few months.

All in all, a busy six months lie before us and we'll report on progress in the next issue of the newsletter in November.

STAFF PROFILES

Over the past decade you may have seen various Australian teams working on Seaframe stations, undertaking surveying missions or, more recently during this phase, establishing CGPS stations. These teams will continue their work over this phase as it is absolutely critical that the various monitoring stations be maintained and upgraded on a regular basis to ensure that the quality of the data generated by the stations is not jeopardised. During this phase these teams will also include technical personnel from SOPAC as part of the process of developing increased local capacity in system maintenance and management which will contribute to sustainability and, importantly, rapid response to any equipment problems.

The technical teams also work with scientific and project management colleagues in Australia and around the region to complete the project team. Through this newsletter we'll be taking the opportunity to introduce these team members to you. Our first four profiles are of characters who have been involved in the project for some time.

Chalapan Kaluwin

Based in the project's regional office which is located at FORSEC headquarters, Suva, Fiji, Chalapan is the regional management face of the project. As Regional Coordinator, he is a key player in liaison between the participating Pacific Island countries, regional organisations and the technical teams. He is also the chairperson of the Information and Training Working Group for the project.

Chalapan has a broad experience working throughout the Pacific region in environmental science and resource management, especially environmental and analytical chemistry and has been involved with the project as Information Officer since Phase I commenced in 1991.

Chalapan is your first point of contact for enquiries about all aspects of the project and particularly if you are looking for copies of any of the project's information products.

Allan Suskin

Allan is based with the National Tidal Facility in Adelaide, South Australia where he is the head of instrumentation. Allan's area of speciality is electronics, especially of marine instrumentation. He leads the Seaframe Calibration and Maintenance team and oversees the installation and technical operations of the climate monitoring stations. You will see Allan and his team around the region ensuring equipment is operational and providing the quality data stream required.

Allan is the key contact point for Pacific Island country counterparts who assist in equipment maintenance and data generation and transfer.

Steve Turner

Steve is also based with the National Tidal Facility in Adelaide, South Australia and is the geodetic survey specialist for the project. He heads the precise levelling team conducting the 1st order levelling missions which ensure that the scientists working on the data generated from the Seaframes are aware of local level movements.

Steve has been involved in many aspects of the geodetic survey work of this project over the past decade, including setting standards, installation and training of counterpart personnel.

Bob Twilley

Bob works within the National Mapping Division of Geoscience Australia. He is the CGPS Specialist for the project, heading the CGPS installation and commissioning team. He is also involved in quality assuring and validating incoming CGPS data.

Apart from his role in the Sea Level and Climate Monitoring Project, Bob is also the project manager for the Australian Regional GPS Network, ARGN.

Bob has been in the surveying profession for over 30 years, working across a spectrum of environments from the tropical South Pacific to the hot, dry Australian deserts and the windy, freezing conditions of Antarctica.

A broad range of data and information products will be generated by the project during Phase III and we are concerned that they be widely distributed to all those interested in the subject matter.

Fact sheets, posters, CD-ROMs of project data, extended monthly data reports and tidal calendars have been prepared and widely circulated through counterpart agencies.

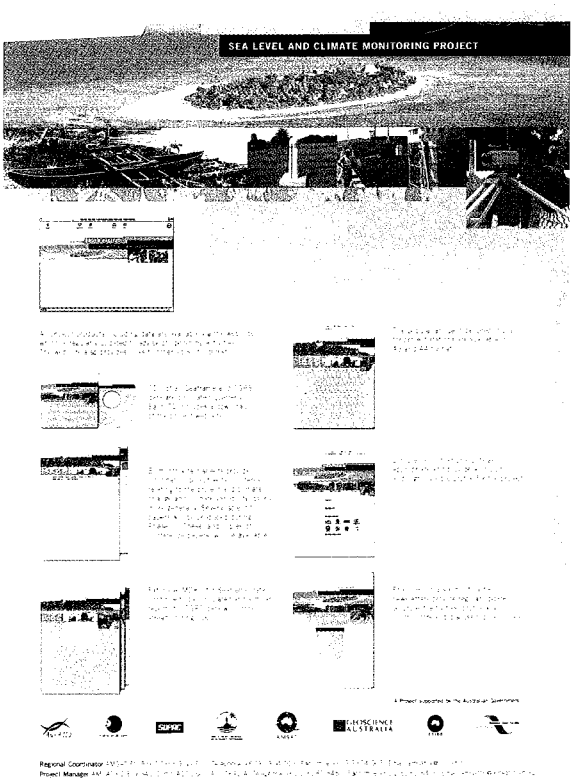
Fact sheets are currently available on the following topics:

- Project background and direction*
- Sea level monitoring*
- CGPS monitoring*
- Coastal erosion
- El Nino and La Nina

Fact sheets to be produced over the coming few months include:

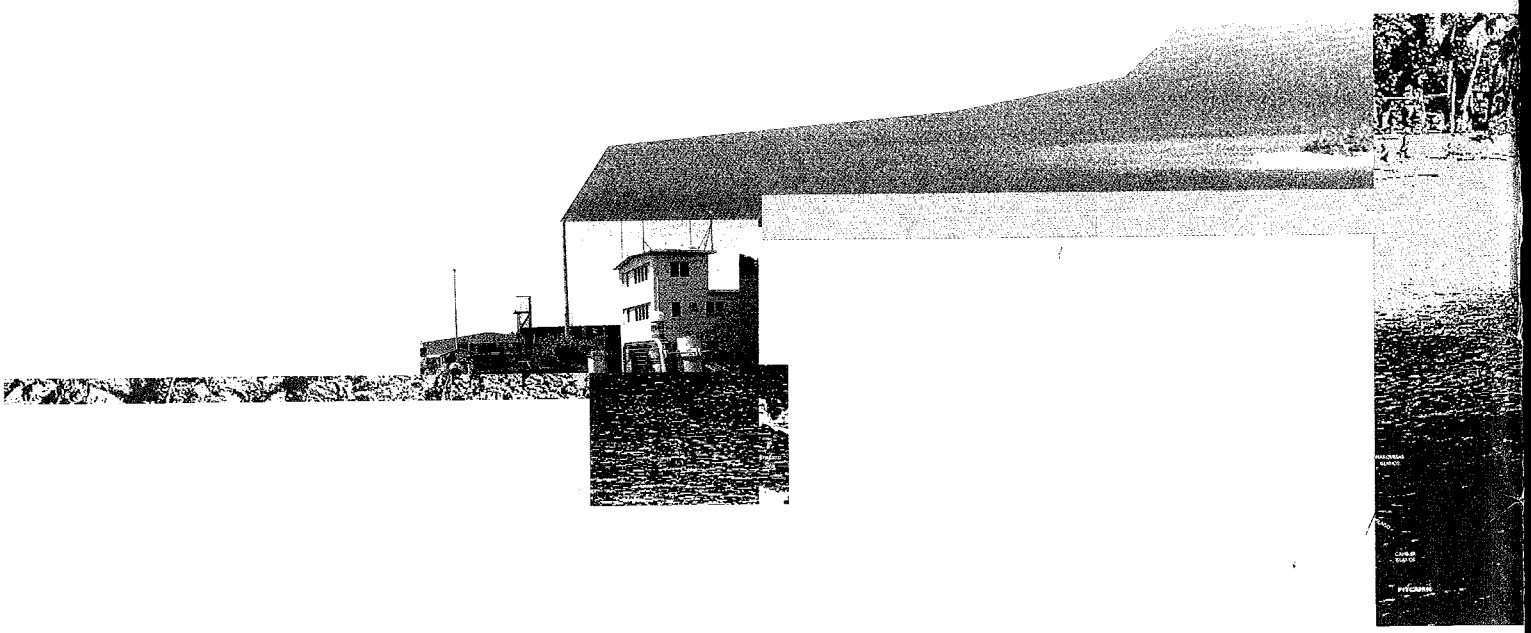
- Extreme Events*
- Using the project web site*
- The IPCC Process and Findings
- International Oceanographic and Marine Meteorological Data
- Storm Surges
- Tsunamis

* Complementary posters are available



Of course some the technical material is directed to specialist agencies however copies of all material are available for downloading from the project web site, www.pacificsealevel.org, which is regularly updated. The site also provides links to other sites of relevance to regional and international climate research and to various data sources.

If you are unable to access the web or have trouble downloading the files you are interested in, please contact the Regional Coordinator's office and we'll arrange for you to be included on our distribution list.



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