



SOPAC Member Countries
National Capacity Assessments:
Tsunami Warning and Mitigation Systems

Vanuatu



Vanuatu



SOPAC



SOPAC Member Countries National Capacity Assessments: Tsunami Warning and Mitigation Systems

VANUATU

Port Vila, 22 - 25 April 2008



SOPAC

Document Control

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Acronyms

ATWS	Australian Tsunami Warning System
ACP	African Caribbean Pacific grouping
ADB	Asian Development Bank
AGD	Australian Attorney-General's Department
AM	Amplitude Modulated
AusAID	Australian Agency for International Development
Bureau	Australian Bureau of Meteorology Bureau
CRP	Comprehensive Reform Programme
D	Document (e.g. Document 39 = D39)
DFAT	Australian Department of Foreign Affairs and Trade
DRM NAP	Vanuatu Disaster Risk Reduction and Disaster Management National Action Plan 2006 – 2016
EMA	Emergency Management Australia (now defunct)
EMWIN	Emergency Managers Weather Information Network
FM	Frequency Modulated
GA	Geoscience Australia
GDP	Gross Domestic Product
GFZ	GeoForschungsZentrum Potsdam (GFZ German Research Centre for Geosciences)
GIS	Geographic Information Systems
GTS	Global Telecommunications System
HAT	Highest Astronomical Tide
HF	High Frequency
ICG	Intergovernmental Coordination Group
IMF	International Monetary Fund
IOC	Intergovernmental Oceanographic Commission
IRD	Institut de Recherche pour le De´veloppement (IRD) France
ISCS	International Satellite Communications System
ISDR	International Strategy for Disaster Reduction
ITSU	ICG for the Tsunami Warning System in the Pacific
MC	Master of Ceremony
MoUs	Memorandums of Understanding
Mw	Moment Magnitude
NDC	National Disaster Council
NDMO	National Disaster Management Office
NDOC	National Disaster Operations Centre
NGOs	Non-Government Organisations
NOAA	National Oceanic and Atmospheric Administration
PAA	Priorities and Action Agenda

Acronyms (Continued)

PDC	Pacific Disaster Centre
PGSP	Pacific Governance Support Programme
PICs	Pacific Island Countries
PTWC	Pacific Tsunami Warning Centre
PTWS	Pacific Tsunami Warning and Mitigation System
RANET	Radio and Internet for the Communication of Hydro-Meteorological Information for Rural Development
REDI	Regional Economic Development Initiative
SMS	Short Message Service
SOPAC	Pacific Islands Applied Geoscience Commission
SOPs	Standard Operating Procedures
TVL	Telecom Vanuatu Limited
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
USA	United States of America
UTC	Coordinated Universal Time
VANGO	Vanuatu Association of NGOs
VHF	Very High Frequency
VMS	Vanuatu Meteorological Service
VTBC	Vanuatu Broadcasting & Television Corporation
WMO	World Meteorological Organisation



1. Results Outline

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1.1. Executive Summary

The National Capacity Assessment of Pacific Islands Applied Geoscience Commission (SOPAC) Member Countries: Tsunami Warning and Mitigation Systems project aims to work in collaboration with the member countries of SOPAC to assess their capacity to receive, communicate and respond effectively to tsunami warnings. The Tsunami Capacity Assessment of the ability of Vanuatu to receive, communicate and effectively respond to tsunami warnings took place in a workshop held from 22 – 25 April 2008 in Port Vila, Vanuatu.

The workshop was facilitated by a team of visiting experts and attended by some 50 Vanuatu Government agency representatives, Non-Government Organisations (NGOs), international organisations and the private sector to discuss key areas of tsunami warning and mitigation in Vanuatu by completing a comprehensive questionnaire in session, presentations and site visits.

As well as outlining Vanuatu's current status, strengths and opportunities for improvement with regard to tsunami warning and mitigation, a list of recommendations were formulated by the visiting assessment team in consultation with national participants. The aim of these recommendations is to guide further capacity development programs to target improvements in Vanuatu's tsunami warning and mitigation system.

The seismicity of the plate boundary zone between the Pacific and Australian plates and the Pacific Ring of Fire mean that Vanuatu is susceptible to tsunami generated by local, regional and distant (or ocean wide) events (from sources 100km, 1000km, >1000km respectively). On the 26 November 1999, at 13:21 Coordinated Universal Time (UTC) (27 November 1999 at 12:21am local time), central Vanuatu was struck by a large offshore earthquake (Moment Magnitude (Mw) 7.5) generated on the New Hebrides trench followed by a tsunami that killed five people and caused significant damage to nearshore structures, mainly at Martelli Bay, south Pentecost Island (Ioualalen, M., et al. 2006, D37). On 2 January, 2002 at 17:22 UTC (3 January 2002 at 4:22am local time), a magnitude Mw 7.2 earthquake (USGS, 2009) struck Port Vila, Efate. Fifteen minutes after the main shock a tsunami struck Port Vila Harbour (Shorten, 2002). Fortunately the tsunami occurred at low tide and did not cause any significant flooding or damage. Local tsunami threat sources for Vanuatu are the New Hebrides, South Solomon and Kermadec Trenches (Warne, 2008). Tsunami travel time to Vanuatu from the New Hebrides trench could be as little as 15 minutes.

Participants in the workshop stated a number of urgent priority areas that need to be addressed and these are presented in Table 3 below. Very high priority recommendations articulated in this report include:

- Continuation of efforts to approve and implement the Vanuatu Disaster Risk Reduction and Disaster Management Arrangements to establish a robust planning framework for all aspects of the Tsunami Warning System within Vanuatu as well as other hazards;
- Review of the National Disaster Management Act (2000) to include legislation regarding the establishment of emergency management structures at the provincial and community level as well as reviewing the legislation regarding monitoring and warning for tsunami and other hazards;
- Develop a tsunami community awareness programme that includes “natural tsunami warning signs” in light of Vanuatu's local tsunami threat sources;

- Incorporate tsunami considerations into working groups established under the Vanuatu National Disaster Risk Reduction and Disaster Management Arrangements (once approved);
- Production of tsunami hazard maps based on existing available studies and data;
- Complete, approve and implement a tsunami “disaster support plan”, tsunami SOPs for all agencies and plans at local levels;
- Investigation and implementation of improved warning dissemination methods to the community;
- Pursue the strategies identified in the Geo-Hazard Unit's Business Plan to facilitate the development of a 24/7 operational capability for the Geo-Hazard Unit in the new Vanuatu Meteorological Service (VMS) building;
- Development of a tsunami capacity development program, including training and exercising for emergency managers, NGO's, Red Cross/Peace Corps and VMS staff and that this be done in a competency-based framework;
- Regular exercising of all aspects of the warning system;
- Ensure key agencies (VMS, Geo-Hazards Unit and National Disaster Management Office (NDMO) are adequately resourced and activated (24/7 or on call) to respond to the tsunami threat; and,
- The Geo-Hazards Unit continue to pursue development of a robust and sustainable national seismic network.

The visiting team and workshop participants noted that Vanuatu has a National Disaster Act that articulates the establishment and functions of the National Disaster Committee (NDC), NDMO and National Disaster Operations Centre (NDOC). It also noted that the Act addresses the need for Provincial Disaster Plans. All of the above provide a sound foundation for the enhancement of the tsunami warning and disaster risk management system.

The visiting team and workshop participants conclude that the highest priority and a significant first step, towards enhancing the tsunami warning and disaster management system, is the adoption of the Vanuatu National Disaster Risk Reduction and Disaster Management Arrangements (draft 2008 is currently with Government for approval) and with that, the establishment of a robust planning framework for all aspects of the tsunami warning system within Vanuatu. This includes development, approval and implementation of a tsunami “disaster support plan”. The physical relocation of the Geo-Hazards Unit, NDMO and VMS into the same office will greatly aid collaboration on all hazards, including tsunami, in an operational and peacetime context.

The visiting team also noted that Vanuatu should be congratulated on their proactive and committed approach to improving disaster risk management arrangements in their country. This is particularly evident through the development and implementation of the Vanuatu Disaster Risk Reduction and Disaster Management National Action Plan 2006 – 2016 (DRM NAP).

Vanuatu workshop participants are encouraged to use this National Tsunami Capacity Assessment report to guide both national projects and externally funded projects to achieve targeted improvements on the Vanuatu tsunami warning and mitigation system. In turn, this will assist in improving systems for other natural hazards such as earthquakes and cyclones.

Contingent on the availability of human and financial resources, the Australian Bureau of Meteorology (Bureau) and project partners will aim to work with potential donors to bring the findings of this project to their attention on a country and regional scale. This will be done in the hope of further capacity development projects being undertaken.

1.2. Recommendations (including priority and resource intensity)

Table 2 outlines the priority and resource intensity for recommendations made to improve Vanuatu's tsunami warning and mitigation system. Both the priority and resource intensity are based on the consensus of the visiting Tsunami Capacity Assessment team after discussions held within the Tsunami Capacity Assessment Workshop as well as subsequent in-country review undertaken in July 2009. It is recognised that these rankings may not reflect the opinions of all individuals involved in the workshop as priorities vary depending on personal responsibilities and areas of interest. Each recommendation is important in its own right to achieve holistic improvements in Vanuatu's tsunami warning and mitigation system.

The priority ranking and resource intensity scale used as a basis for allocating a priority and resource intensity to each recommendation is explained in Table 1. The **Very High priority** recommendations should be seriously considered as requiring urgent completion. **Low resource intensity recommendations** are considered the 'low-hanging fruit' that are achievable with very few additional resources.

Table 1: Priority ranking and resource intensity scale

PRIORITY	RESOURCE INTENSITY
Very High	Low – Recommendation currently being progressed or could possibly be progressed within the capacity of existing in-country resources (funds and staff).
High	Medium – Recommendation could be progressed by existing staff or with a low to moderate number of additional staff and/or expertise and a moderate level of additional in-country funds. May or may not require external funding.
Medium	High – Recommendation would require a high level of additional staff and/or expertise and funds. External funding support is likely to be required.
Low	Very High – Recommendation would require a very high level of additional staff and funds. External funding support will be required.

Table 2: Priority and anticipated resource intensity for completion of recommendations made for improving Vanuatu's tsunami warning and mitigation system.

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
Very High	That the Geo-Hazards Unit, NDMO and VMS operations be enhanced to allow for the 24/7 receipt of tsunami information and activation of tsunami response operations via redundant communications means including an Short Message Service (SMS) alert from the Pacific Tsunami Warning Centre (PTWC) and that the key individuals within these agencies be identified to receive the SMS alert.	Low	Communications	Tsunami specific	23
Very High	That through the implementation of the Vanuatu Disaster Risk Reduction and Disaster Management Arrangements and DRM NAP particular attention is paid to the development of strong links between activities at the national, provincial and local level.	Low	Governance & Coordination	Multi-hazard	4
Very High	Incorporate the benefits of implementation of improvements in the tsunami warning system across all hazards.	Low	Governance & Coordination	Multi - hazard	5
Very High	Review of the National Disaster Management Act (2000) and ensure consistency between this and other Acts. Include legislation regarding the establishment of emergency management structures at the provincial and community level which are responsible for emergency planning and operational readiness. Also review the legislation regarding monitoring and warning for tsunami and other hazards.	Low	Governance & Coordination	Multi hazard	2

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
Very High	Ensure the current initiatives to approve and implement the Vanuatu Disaster Risk Reduction and Disaster Management Arrangements continue to establish a robust planning framework for all aspects of the tsunami warning system within Vanuatu as well as other hazards.	Low	Governance & Coordination	Multi-hazard	1
Very High	Because local tsunami pose a significant threat to Vanuatu ensure that environmental cues are included as a key message when developing and delivering public awareness campaigns.	Low	Public & Stakeholder Awareness and Education	Tsunami specific	40
Very High	That emergency plans at national, provincial and local levels be developed and these plans should contain detailed arrangements for each of the threats related to Vanuatu including tsunami. The plans should detail and formalise warning systems in place and the preparation of this plan should include the production of evacuation maps and community consultation. When completed plans should be made available to the public and evacuation maps displayed in prominent locations within communities.	Medium	Governance & Coordination	Multi-hazard	8
Very High	Incorporate tsunami considerations into working groups established under the Vanuatu National Disaster Risk Reduction and Disaster Management Arrangements on which key agencies and at-risk communities are represented. This will ensure tsunami risk assessment, planning, community education and capacity development considerations and activities are undertaken within a multi-hazard context.	Medium	Governance & Coordination	Tsunami specific	3

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
Very High	Use the tsunami hazard studies that have been completed for the Southwest Pacific Nations to date, historical tsunami records and studies, earthquake hazard studies, existing tsunami modelling, deep ocean tsunami models and topography data to identify low-lying communities which may be prone to tsunami impacts from all likely tsunami sources and produce a suit of hazard maps. Commence tsunami mitigation (structural and non-structural management options), response and evacuation planning using local knowledge.	Medium	Tsunami Hazard, Vulnerability & Risk	Tsunami specific	34
Very high	Complete, approve and implement a tsunami “disaster support plan” under the Vanuatu Disaster Risk Reduction and Disaster Management Arrangements once approved. Include consideration of critical infrastructure and lifeline support facilities.	Medium	Emergency Response & Evacuation	Tsunami specific	28
Very High	VMS continues to develop strong capability to respond to the tsunami threat through the establishment of 24/7 operations based on strong procedures developed with stakeholders. In the short term the response of 24/7 staff at Airport should be formalised.	High	Tsunami Warnings	Tsunami specific	16
Very High	The Geo-Hazards Unit continue to pursue development of a robust and sustainable national seismic network (including training of the maintenance and operational use of data) and promote seismic data sharing internationally and with neighbouring countries in the region.	High	Tsunami Warnings	Multi-hazard	15

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
Very High	<p>That improved warning dissemination methods be investigated including evaluation of different methodologies which would best suit the Vanuatu context, including community based and traditional methods. Examples include:</p> <ul style="list-style-type: none"> a. The suitability of SMS be investigated as a means to complement other dissemination methods; b. Communicating with remote communities including the use of sirens, drums, gongs c. If full coverage is available from Radio Vanuatu, transmission options for automatic warning tones in remote communities exist; d. As availability/affordability grows, the internet be investigated as a means to deliver up to date warnings and educational information to the community; e. Formats used to disseminate warning information be flexible enough to meet the needs of a wide range of users and delivery mechanisms; f. Establishing links with NGO's, the Red Cross/Peace Corps to assist the dissemination of warnings; and g. Use of the mobile phone network web access. 	High	Tsunami Warnings	Multi-hazard	20

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
Very High	That all agencies involved in tsunami warning and response develop Standard Operating Procedures (SOPs) consistent with the Vanuatu National Disaster Risk Reduction and Disaster Management Arrangements. These procedures should contain details about each agency's operational response to tsunami. The SOPs should formalise points of contact between each relevant agency in the warning system in all hours of operation and include mechanisms to communicate with other government departments, NGOs, Red Cross/Peace Corps and the community.	High	Governance & Coordination	Tsunami specific	9
Very High	That NDMO facilities located within the new VMS building, include enough resources and space for the coordination of operations and the display of critical information during emergencies.	High	Emergency Response & Evacuation	Multi-hazard	32
Very High	That the responsible national working group, in coordination with NDMO and other key government agencies, NGOs, Red Cross/Peace Corps and donor organisations establish a comprehensive tsunami public awareness program based on risk where possible. The programme should aim to improve the awareness and preparedness of the Vanuatu population by considering the production of education material and delivery based on proven methods to the Vanuatu community in multiple languages.	High	Public & Stakeholder Awareness and Education	Tsunami specific	39
Very High	That a tsunami capacity development program be developed, including training and exercising for emergency managers, NGOs, Red Cross/Peace Corps and VMS staff and that this be done in a competency-based framework	Very High	Public & Stakeholder Awareness and Education	Tsunami specific	43

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
Very High	That all aspects of the warning system are exercised regularly and in a structured way; both within Vanuatu and by taking part in international exercises to ensure that the response to tsunami warnings is effective at all times.	Very High	Tsunami Warnings & Emergency Response	Tsunami specific	21
Very High	Pursue the strategies identified in the Geo-Hazard's Unit Business Plan to facilitate the development of a 24/7 operational capability for the Geo-Hazard Unit in the new VMS building.	Very High	Governance & Coordination	Multi-hazard	6
High	In the short term community education programs could make use of existing generic tsunami education material available through SOPAC and delivery strategies such as National Disaster Awareness Week and schools programs. This material could also be made available to NGOs, Red Cross/Peace Corps and donor organisations for distribution amongst at-risk communities.	Low	Public & Stakeholder Awareness and Education	Tsunami specific	41
High	That a Vanuatu Association of NGOs (VANGO) be formally established as the primary national focal point for NGOs in terms of disaster management and risk reduction activities.	Low	Governance & Coordination	Multi-hazard	7
High	To complement a public awareness program, the establishment of tsunami signage within urban areas should be investigated to assist in the awareness of transient populations such as tourists, including signage in hotels and resorts.	Low	Public & Stakeholder Awareness and Education	Tsunami specific	42

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
High	That media outlets be used to assist in community awareness and preparedness campaigns and an multi-hazard media education campaign be developed and delivered to ensure the media are educated on natural hazards, warning and response systems.	Low	Public & Stakeholder Awareness and Education	Multi-hazard	44
High	Vanuatu Meteorological Service and the NDMO to develop formal Memorandums of Understanding (MOU) with radio stations regarding the broadcast of emergency information including agreements regarding broadcasting of warning information outside normal hours of operation.	Low	Communications	Multi-hazard	26
High	That any planning for a future warning service take into account the expanding capabilities delivered by anticipated radio and mobile telephone coverage.	Low	Communications	Multi-hazard	24
High	Develop strategies to enhance the dissemination of warnings to all communities through the use of satellite phones.	Low	Communications	Multi-hazard	25
High	Investigate the feasibility of current satellite technology to alert remote communities of tsunami warnings including pursuing the pilot trial of the RANET (Radio and Internet for the Communication of Hydro-Meteorological Information for Rural Development) Chatty Beetle.	Low	Communications	Multi-hazard	27
High	Continue the moves towards Intergovernmental Coordination Group (IOC) Membership and development of linkages with Institut de Recherche pour le Développement (IRD).	Low	Regional & International Coordination	Multi-hazard	10

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
High	Incorporate into tsunami SOPs the issuing of 'No Threat' messages to the community for tsunami that will not impact on Vanuatu or earthquakes that do not have the potential to generate tsunami. This will avoid misinterpretation of media and international family information. This will also test the system and enhance community awareness when there is a long time between events.	Low	Tsunami Warnings	Tsunami specific	19
High	That the response to any exercises, real events or near-event is reviewed with a Lessons Learned Workshop and the results be made available to all stakeholders and accountability for improvements is delegated and followed up on.	Medium	Emergency Response & Evacuation	Tsunami specific	29
High	That plans be developed that recognise public broadcasts as a vital part of the preparedness, response and recovery stage following a disaster and that this is captured in MOUs with radio stations regarding the broadcast of emergency information.	Medium	Emergency Response & Evacuation	Multi-hazard	30
High	That information systems are established to enable emergency response personnel to access data that could potentially assist in response and recovery in a real event (e.g. Geographic Information Systems (GIS) layers of critical infrastructure). These information systems should also have the capability to adequately record critical event-based information and that this is shared across agencies.	High	Emergency Response & Evacuation	Multi-hazard	31
High	That government planning includes an assessment of the impacts of works near the coastal interface (for example, sand excavation) and the natural hazard risk potential for new developments.	High	Tsunami Hazard, Vulnerability & Risk	Multi-hazard	38

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
High	That work related to capacity building is complemented with resources that assess its ongoing effectiveness.	High	Public & Stakeholder Awareness and Education	Tsunami specific	45
High	Building on lessons learned from the Tropical Cyclone Warning System, that Vanuatu investigate the development of contingency plans that allow the issue of public warnings from another country and/or a back-up agency in country (to receive warnings from PTWC and disseminate nationally).	High	Tsunami Warnings	Multi-hazard	22
High	VMS obtain access to a tsunami deep ocean model scenario database to assist in determining threat levels to Vanuatu and inform appropriate warning decisions. Adequate ongoing training to use this database would be required.	High	Tsunami Warnings	Tsunami specific	18
High	VMS investigate use of available scientific data and tools (deep ocean tsunami models, sea level data and travel time software) to assist in localising the threat to Vanuatu and incorporate use of these tools into tsunami SOPs.	High	Tsunami Warnings	Tsunami specific	17
High	Investigate the current status of volcano monitoring within Vanuatu and evaluate the tsunamigenic potential of major volcanoes and feed this into tsunami plans.	Very High	Tsunami Hazard, Vulnerability & Risk	Tsunami specific	37
Medium	Continue active participation in the Southwest Pacific Tsunami Working Group (WG5) of the Intergovernmental Coordination Group (ICG) of the Pacific Tsunami Warning and Mitigation System (PTWS), Regional Meteorological Service Directors meeting and the Pacific Platform for Disaster Risk Management meetings, engaging VMS, the Geo-Hazards Unit and NDMO in these forums.	Medium	Regional & International Coordination	Multi-hazard	11

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
Medium	Conduct an inventory of geospatial data available for tsunami and multi-hazard risk assessments, modelling and mapping of populated areas.	Medium	Tsunami Hazard, Vulnerability & Risk	Multi-hazard	34
Medium	Actively pursue the acquisition of data from previous and future research projects conducted in country and develop a protocol to do this.	High	Research Expertise	Multi-hazard	14
Medium	Investigate possible future options for further inundation modelling for prioritised communities.	High	Tsunami Hazard, Vulnerability & Risk	Tsunami specific	36
Medium	Acquire the necessary baseline data for populated areas to fill identified gaps as part of a multi-hazard mapping activity.	Very high	Tsunami Hazard, Vulnerability & Risk	Multi-hazard	35
Low	That those Tsunami Capacity Assessment recommendations that are common across a number of Pacific Island Countries (PICs) be made available to SOPAC and other regional and international organisations for consideration.	Low	Regional & International Coordination	Multi-hazard	12
Low	Actively cooperate and seek to develop partnerships with universities and regional and international agencies that can assist with conducting scientific research and technical capacity building in Vanuatu with regards to all facets of tsunami management.	Low	Research Expertise	Tsunami specific	13



2. Project Background

2. Project Background

2.1. About the Project

The National Capacity Assessment of SOPAC Member Countries: Tsunami Warning and Mitigation Systems project aims to work in collaboration with the member countries of SOPAC to assess their capacity to prepare for, receive, communicate and respond effectively to tsunami warnings. The Australian Bureau of Meteorology (the Bureau) is the lead implementing agency, in partnership with the Australian Attorney-General's Department (AGD), (formerly Emergency Management Australia (EMA)), SOPAC, and with the assistance of the Intergovernmental Oceanographic Commission (IOC) a division of the United Nations Educational, Scientific and Cultural Organization (UNESCO). The project is funded by the Australian Agency for International Development (AusAID) under the Pacific Governance Support Programme (PGSP). It is implemented under an agreement (Schedule 5 to the Record of Understanding 14304, June 2006) between AusAID and the Bureau). The fourteen SOPAC member countries participating in the project are the Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, the Solomon Islands, Tonga, Tuvalu and Vanuatu.

2.2. Broad Project Aim

By undertaking an assessment of the capacity of individual nations to manage tsunami events, the project aims to better guide donor funding towards achieving targeted improvements in the tsunami warning and mitigation systems in the respective countries.

2.3. Key Project Output

The key deliverable of the project is a comprehensive set of reports, including one National Report specific to each country, detailing the strengths and opportunities for improvement of the country with regard to tsunami warning and mitigation. The National Report for each country also includes recommendations to address priority issues. These reports will then feed into a consolidated Regional Report that will aim to identify common issues across the Region with regard to tsunami warnings and mitigation.

2.4. Project Methodology

National assessments in each SOPAC member country are conducted by visiting teams including experts in the fields of tsunami warnings, emergency management, disaster risk reduction and data and warning communications. The visiting team meets with in-country experts during a four-day workshop involving government agencies, the private sector, NGOs and regional and international organisations involved in tsunami and disaster risk management.

The workshop aims to complete a questionnaire covering all aspects of tsunami warning and mitigation and gather information to support questionnaire responses. This information then feeds

into the National Report. Consultation with individual countries before completion of the report is an integral part of the report writing process.

The questionnaire for the PICs is a modified version of that used for the Indian Ocean equivalent project. The Indian Ocean questionnaire was jointly developed by UNESCO/IOC, SOPAC, the World Meteorological Organisation (WMO) and the International Strategy for Disaster Reduction (ISDR). Details of the Indian Ocean equivalent project can be found at <http://ioc3.unesco.org/indotsunami/nationalassessments.htm>

2.5. Underlying Policy Objectives of the Australian Tsunami Warning System Project

The Bureau in partnership with Geoscience Australia (GA) and AGD, has recently completed a four-year project to establish the Australian Tsunami Warning System (ATWS). One of the three policy objectives of the ATWS project was “To contribute to the facilitation of tsunami warnings for the South West Pacific” (Australian Department of Foreign Affairs and Trade (DFAT), 2006). The Tsunami Capacity Assessment project and this report, contributes to the achievement of this policy objective. Also, as part of the implementation of the ATWS, Australia has and will continue to contribute to the facilitation of more effective tsunami advisory bulletins to PICs through the provision of seismic and sea level observations to the PTWC in Hawaii.

2.6. Tsunami warnings in the Pacific

Tsunami messages for the Pacific Ocean are issued by the PTWC in Hawaii as the United States of America (USA) contribution to the PTWS. Individual countries are then responsible for using this advice to distribute national tsunami warnings to their communities. PTWC messages can be Tsunami Warnings, Tsunami Watches, Tsunami Advisories and Tsunami Information Bulletin/Statements. For the purpose of this report, products from the PTWC will be referred to generically as ‘tsunami messages’.

A full definition of each PTWC product products can be found at:
http://www.prh.noaa.gov/ptwc/about_messages.php

2.7. International Tsunami Forums

Under the auspices of the IOC, the ICG/PTWS (formerly known as ICG for the Tsunami Warning System in the Pacific (ITSU)) was first convened in 1968 (IOC, 2009). This is an international cooperative effort involving many IOC Member States of the Pacific Region. The ICG/PTWS meets regularly to review progress and coordinate activities resulting in improvements of the service (IOC, 2009).

The Working Group on Tsunami Warning and Mitigation in the Southwest Pacific Ocean was formed at the ICG/PTWS-XXI meeting in Melbourne in early May 2006 with the aim of enhancing tsunami warning and mitigation in the Southwest Pacific Ocean. The membership of the working group is composed of representatives from IOC Member States and other countries in the region (as members and observers). SOPAC provides secretariat support. The Working Group is currently chaired by a representative of New Zealand, with vice-chairs from Fiji and Samoa.

The Working Group has a number of Terms of Reference and this project is directly relevant to the following Terms of Reference:

- To evaluate capabilities of countries in the Southwest Pacific Region for providing end-to-end tsunami warning and mitigation services;
- To ascertain requirements from countries in the Southwest Pacific Region for the tsunami warning and mitigation services;
- To facilitate capacity building and the sharing of tsunami information in the region;
- To support the further development of the virtual centre of expertise in a multi-hazards context within SOPAC in line with the Regional Early Warning Strategy; and
- To facilitate the inclusion of tsunami hazard and response information into curricula, and development and dissemination of education materials.



3. Country Background and the Tsunami Threat

3. Country Background and the Tsunami Threat

3.1. About Vanuatu

The capital city of the Republic of Vanuatu is Port Vila located on the island of Efate (Figure 1b). Vanuatu is comprised of around 80 islands, the land area of which is 12,189 square kilometres with a population of 221,417 (as at 2007). The President of the Republic (the Constitutional Head of State) is elected for a five year term through secret ballot by an electoral college comprising Parliament and the Presidents of Vanuatu's six provincial governments (DFAT, 2009). Vanuatu has a unicameral 52-member Parliament, elected to a four year term by universal adult suffrage (DFAT, 2009).

Vanuatu joined the Commonwealth and the Pacific Islands Forum at the time of its independence in 1980 (DFAT, 2009). Vanuatu is also a member of SOPAC, the Francophone Community, the United Nations and several specialised agencies, and of the Non-Aligned Movement. Vanuatu is a member of the International Monetary Fund (IMF), World Bank, Asian Development Bank (ADB) and the African Caribbean Pacific (ACP) grouping enjoying special relations with the European Union. Vanuatu has diplomatic relations with 74 countries (DFAT, 2009).

The Vanuatu economy has recently experienced strong and sustained Gross Domestic Product (GDP) growth driven largely by tourism and construction (DFAT, 2009). While Vanuatu's economic growth is starting to become more broad-based, it remains centred on tourism with more than 167,000 visitors in 2007 and directly employing an estimated 1,200 people (DFAT, 2009).

The vast majority of the population, over 70-80 per cent of who reside in rural areas, is engaged in subsistence agriculture and is concentrated in coastal areas. Further, much of the infrastructure and economic resources are also located in the coastal zone. These factors greatly increase the vulnerability and risk to the community and the economy from tsunami events.

Vanuatu is geographically located in the Pacific "ring of fire" and the 'cyclone belt' and therefore regularly suffers from volcanic eruptions, cyclones, earthquakes, droughts and floods some of which are increasing in frequency, variability and extremes due to climatic variability and sea level rise associated with climate change (D3). The 2002 Port Vila earthquake damage and loss was estimated to be over US\$2.5 m (D3).

In addition to the nations archipelagic characteristics and wide distribution of a number of small islands in a large ocean, increasing population, uncontrolled growth of urban centres and spontaneous peri-urban settlements are contributing to increased levels of vulnerability (D3).

Vanuatu's attempts to meet national aspirations and sustainable development goals at a national, provincial and community level are articulated in the Comprehensive Reform Programme (CRP) and Priorities and Action Agenda (PAA), and also reflected in the Regional Economic Development Initiative (REDI) (D3). Vanuatu's commitment to disaster risk management is cemented by their DRM NAP (D3, 2006 – 2016). This key document should be read in conjunction with this Tsunami Capacity Assessment National Report for Vanuatu.



Figure 1a: Location of Vanuatu in the Pacific Ocean.

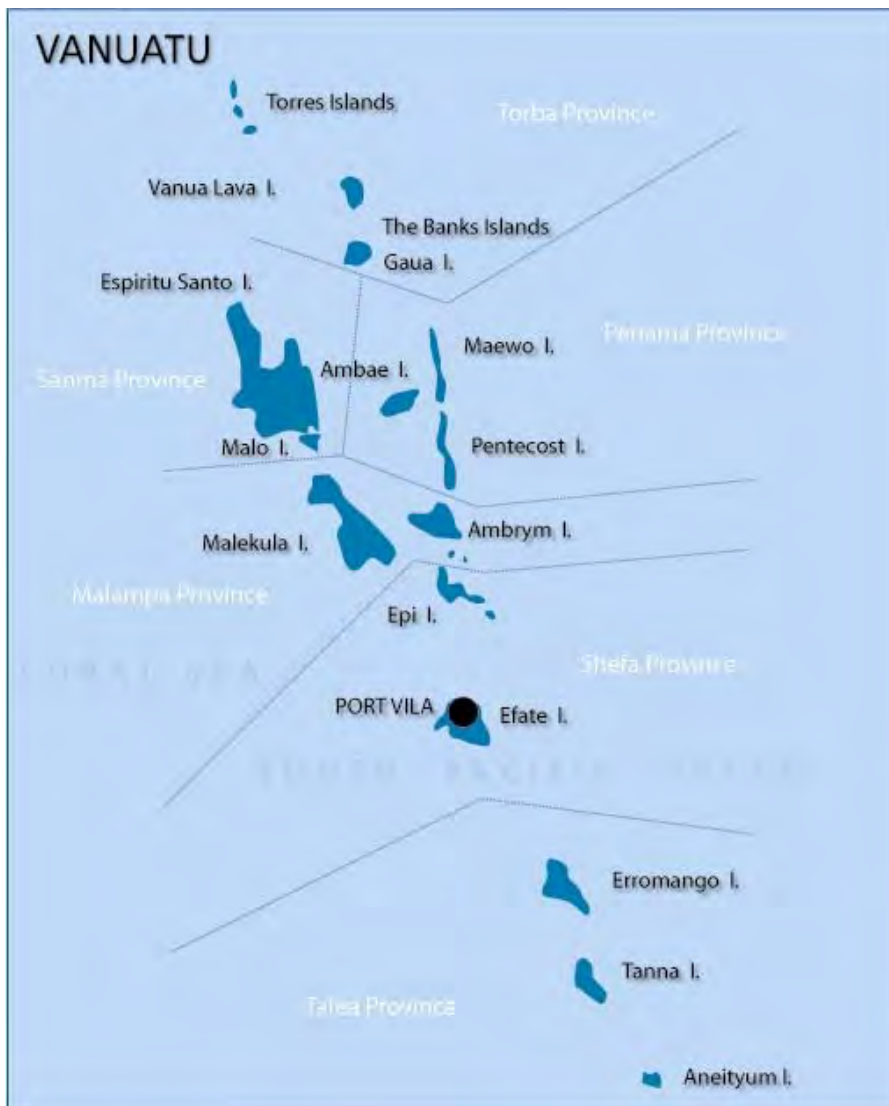


Figure 1b: Vanuatu map (Source: The Bureau based on map supplied by VMS)

3.2. Tsunami Threat Sources and Tsunami History in Vanuatu

An overview of potential tsunami threat sources and tsunami history in Vanuatu is outlined below. This information should be treated as general background and does not attempt to provide a comprehensive picture of tsunami hazard and vulnerability and associated risk for Vanuatu. Such a study is outside the scope of this project.

Vanuatu's draft National Disaster Risk Reduction and Disaster Management Arrangements (D2, 2008) states that "earthquake and associated tsunamis present a high, but infrequent risk to Vanuatu". The arrangements state that "the main threat area is to the northern and central islands, and the islands with active volcanos" (D2).

The seismicity of the plate boundary zone between the Pacific and Australian plates and the Pacific Ring of Fire mean that Vanuatu is susceptible to tsunami generated by local, regional and distant (or ocean wide) events (from sources 100km, 1000km, >1000 km respectively). The impact of tsunami on a coastline will be variable and dependant upon a number of factors including the characteristics of the source earthquake, the shape of the seafloor between the source and the affected area, the topography of the coastline and the orientation of the land in comparison to the source.

On the 26 November 1999, at 13:21 UTC (27 November 1999 at 12:21am local time), central Vanuatu was struck by a large offshore earthquake (Mw 7.5) generated on the New Hebrides trench followed by a tsunami that killed five people and caused significant damage to nearshore structures, mainly at Martelli Bay, south Pentecost Island (Ioualalen, M., et al 2006, D37). This earthquake was the most damaging earthquake in central Vanuatu since the Mw 7.1 event in Santo in October 1971 (Ioualalen, M., et al 2006). A maximum tsunami runup height of seven to eight metres above sea level was measured (by plants killed by salt water) at the mouth of a small river just south of Pamal village (Ioualalen, M., et al 2006). One eyewitness reported a water withdrawal succeeded by three waves, the first of which was smaller than the others and arrived within about 10 minutes of the earthquake (Ioualalen, M., et al 2006). In one village the receding water warned residents to run off the shore line.

On 2 January, 2002 at 17:22 UTC (3 January 2002 at 4:22am local time), a magnitude Mw 7.2 earthquake (USGS, 2009) struck Port Vila, Efate. The earthquake was located 50 km west of Port Vila and at the shallow depth of 21 km below the sea floor (Shorten, 2002, D32). Fifteen minutes after the main shock (according to the Australian National Tidal Facility), a tsunami struck Port Vila Harbour (Shorten, 2002). The tsunami registered on the tide gauge as having an amplitude of 0.8 metres with eyewitnesses claiming effects of around three metres could be seen (Shorten, 2002). The tsunami occurred at low tide and fortunately did not cause any significant flooding over the Highest Astronomical Tide (HAT) level (Shorten, 2002).

More recently the tsunami event generated by an Mw 8.1 earthquake on the South Solomons Trench on 1 April, 2007 at 20:39 UTC (2 April 2007 at 7:30am local time) was detected at Port Vila (Refer to Figure 4). Vanuatu was placed under a tsunami warning for this event by PTWC. This event was used throughout the tsunami capacity assessment of Vanuatu as a case study.

Thomas, Burbidge and Cummings, 2007 (D26) completed *A Preliminary Study into the Tsunami Hazard faced by Southwest Pacific Nations*. Scenarios for an 8.5 Mw and 9.0 Mw earthquakes were used to investigate normalised offshore (to a notional depth of 50 metres) wave amplitudes for tsunami caused by earthquakes along subduction zones (Refer to Figure 2). For both Mw 8.5 and Mw 9.0 events Vanuatu was placed in Category 5 (normalised amplitude of >250cm). In this study, Vanuatu's maximum amplitude for all tide gauges for all Mw 9 tsunami was 450cm with the most significant source regions being New Hebrides, Tonga, Aleutians, South Solomon, Kermadec, Kuril and Nankai-Ryukyu (amplitude greater than 75cm at 50m depth or single most

significant source region if no amplitude exceeds 75cm). For a Mw 8.5 tsunami Vanuatu's maximum amplitude for all tide gauges was 380cm with the most significant source regions being New Hebrides, South Solomon, Tonga and Kermadec.

A further study completed by Thomas and Burbidge (2009, D27) attempts to answer the question "which Pacific nations might experience offshore amplitudes large enough to potential result in hazardous inundation, what are the probabilities of experiencing these amplitudes and from which subduction zones might these tsunami originate". The report states that the New Hebrides trench, which lies just to the west of Vanuatu, is the primary source of hazard for the country. Maximum amplitudes for a 2000 year return period are therefore significantly higher on the western shores of the major islands over those on the eastern shores (Thomas and Burbidge, 2009). Values of over 4.0 metres at a 2000 year return period were calculated on Espiritu Santo, Malakula, Efate, Erromango, Tanna and Aneityum. Maximum amplitudes at the more easterly islands are lower, but still potentially hazardous (for example, reaching 1.9 metres near Pentecost (Thomas and Burbidge, 2009). At a 100 year return period maximum amplitudes of up to 0.6 to 0.7 metres can be expected at some model output points (Thomas and Burbidge, 2009).

Investigation of the Bureau's deep ocean model-based tsunami prediction system conducted by Dr. Jane Warne in 2008 (ATWS Project Network Design Manager) demonstrated that the local threat sources (Figure 2b) for Vanuatu are the New Hebrides (primarily the central section of the trench), South Solomon (primarily the central section of the trench) and Kermadec trenches with some threat from the southern end of the Tonga trench. Travel times for tsunami from these sources vary from less than approximately 20 minutes for tsunami generated on the New Hebrides trench to reach Port Vila up to four hours from tsunami generated on the Tonga and Kermadec trenches to reach Luganville. This variation is due in part to the longitudinal distribution of the islands from approximately 10° south to 20° south. Travel times to Port Vila are typically half an hour shorter than those to Luganville except for tsunami generated on the South Solomon trench. The times to the eastern islands may be longer depending on the complexity of the reefs and sea-bed within the archipelago.



Figure 2a: The subduction zones (in orange) of the Pacific Ocean



Figure 2b: The location of Vanuatu and other Pacific Island Countries in relation to regional and local subduction zones (in orange)

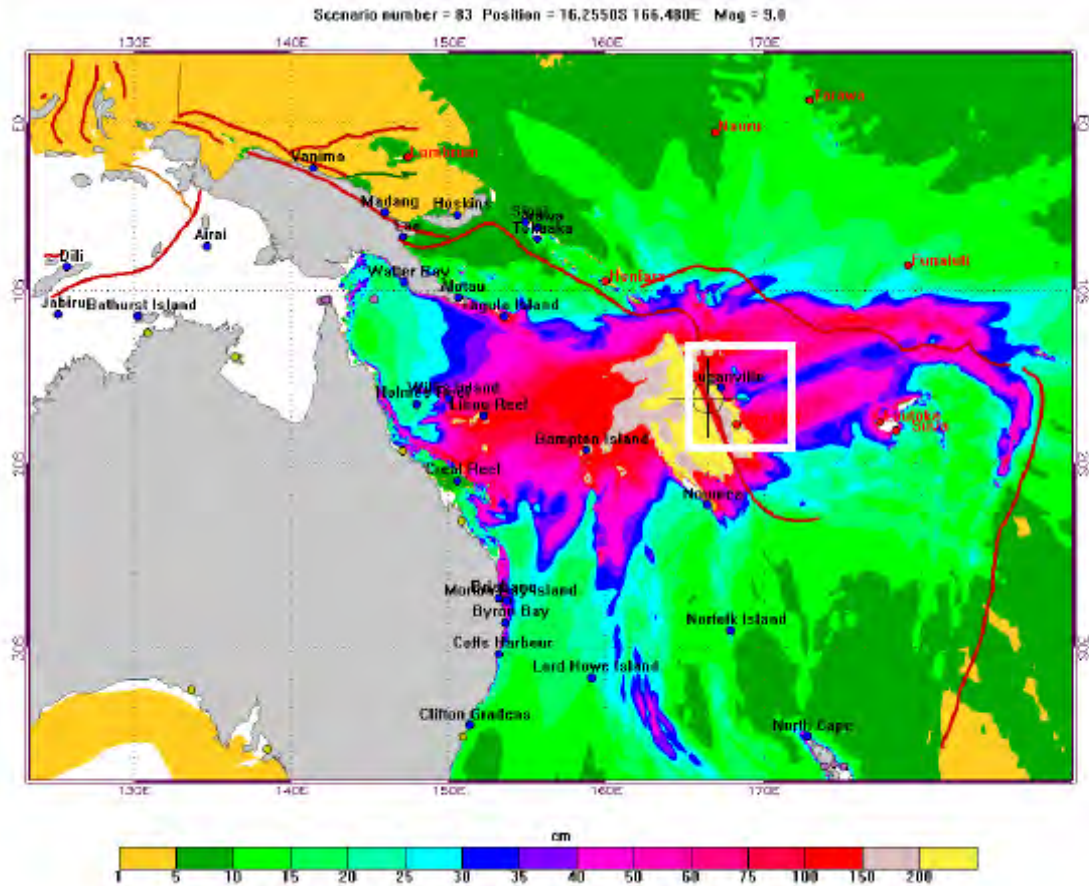


Figure 3: A deep water tsunami scenario for an extreme magnitude 9 earthquake occurring on the central New Hebrides trench. Vanuatu is located within the white square. (Source: Greenslade et al., 2007)

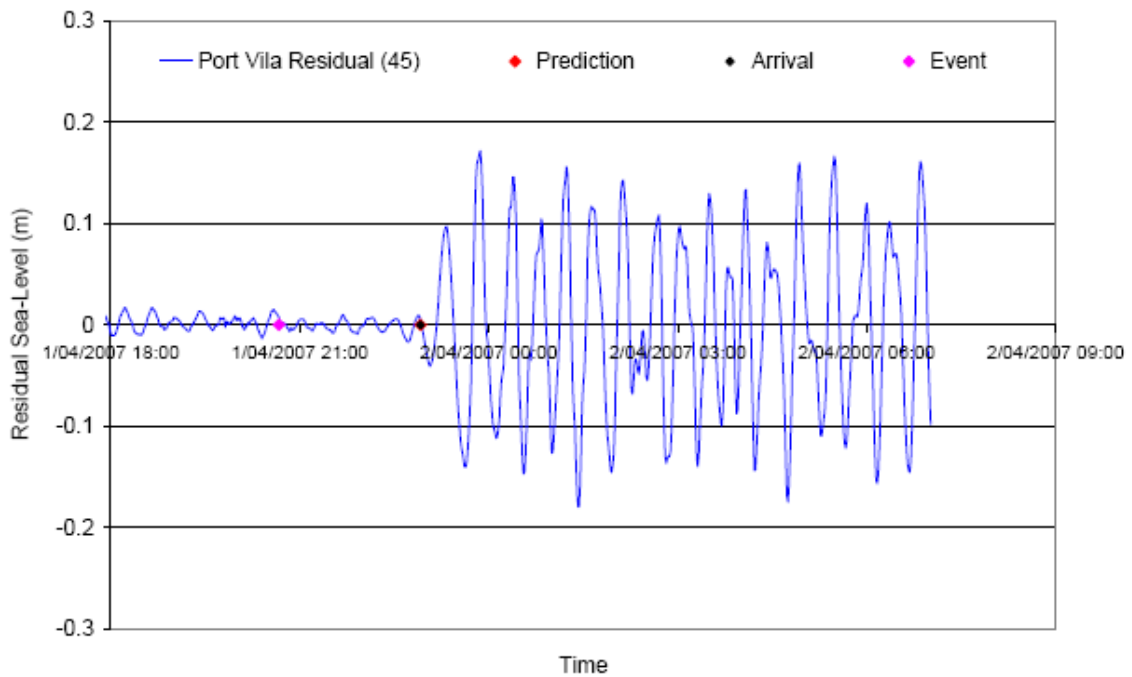


Figure 4: The 1 April 2007 Solomon Islands Tsunami as detected at Port Vila, Vanuatu (source: Bureau of Meteorology National Tidal Centre)



4. The Vanuatu Tsunami Capacity Assessment

4. The Vanuatu Tsunami Capacity Assessment

4.1. Date and Location

The Tsunami Capacity Assessment of the ability of Vanuatu to receive, communicate and effectively respond to tsunami warnings took place from 22 – 25 April 2008 at the Melanesian Hotel, Port Vila, Vanuatu.

4.2. Visiting Assessment Team and Participants

The visiting assessment team was made up of those outlined in Annexure 2. The focal point in Vanuatu for the completion of this project was Mr Jotham Napat, Director, VMS. A full list of workshop participants can be found in Annexure 1.

4.3. Workshop Summary

For a copy of the full agenda for the workshop see Annexure 3.

4.3.1. Day 1 (22 April 2008)

Opening Ceremony (Master of Ceremony (MC) - Jotham Napat, Director of Meteorology)

- Opening and Welcome Remarks (MC: Mr. Jotham Napat)
- Speech 1 – Australian High Commissioner, His Excellency John Pilbeam
- Opening Address – Advisor to the Minister for Public Utilities and Infrastructure
- Response – Visiting Assessment Team Leader, Rob Webb
- Closing Dedication (Jotham Napat)
- Group Photograph

Presentations:

- Rob Webb – Background to the ATWS and the Capacity Workshops
- Noud Leeders – Tsunami causes and threat in Vanuatu
- Ms Esline Garaebiti, Manager, Geo-Hazards Unit - Tsunami warning and mitigation in Vanuatu

Afternoon:

- Focus groups looking at priorities for the tsunami warning system in Vanuatu
- The tsunami assessment questionnaire was worked through.

4.3.2. Day 2 (23 April 2008)

In the morning session, the questionnaire was worked through.

Two buses were hired during the afternoon to take the workshop on a number of site visits. These were

- The Port Vila Tide Gauge
- The Vanuatu Meteorological Service
- The temporary home of Geo-Hazards Unit
- VTBC – Vanuatu Broadcasting & Television Corporation
- TVL – Telecom Vanuatu Limited

4.3.3. Day 3 (24 April 2008)

On day three the questionnaire was completed. The visiting assessment team then talked the assembled group through the New South Wales response to the April 2007 Solomon Islands tsunami including lessons learned and the questions raised. This response was compared to Vanuatu's experience and it was found that the community reaction was similar to the warnings issued. The day finished with a preliminary discussion about the recommendations.

4.3.4. Day 4 (25 April 2008)

The visiting assessment team presented the preliminary recommendations and these generated significant discussion. In the afternoon, VMS hosted a function attended by the Deputy Prime Minister of Vanuatu, Hon Edward Natapi.

4.4. Workshop Photos (Port Vila, April 2008)



Workshop Participants



Opening Speeches (L-R): Rob Webb (Australian Bureau of Meteorology). HE John Pilbeam (Australian High Commissioner), the Advisor to the Minister for Public Utilities and Infrastructure and Jotham Napat (Director, Vanuatu Meteorological Service)



5. Assessment Results

5. Assessment Results

5.1. Status of Key System Components

The Tsunami Capacity Assessment Workshop results are summarised below in Table 3 in which the status of key components of Vanuatu's tsunami warning and mitigation system are outlined (as at the date the Tsunami Capacity Assessment Workshop was held in April 2008, updates between then and the publication of this report are as marked).

Table 3: Summary of current status of key components of the Vanuatu tsunami warning and mitigation system as at April 2008.

Rating

Yes - fully realised
Partially realised
No - not realised

Key Component	Rating	Comment
Authority, Coordination and NGO Role		
Legislation in place for tsunami warnings and response	Partially	<p>Meteorological Act (1989, D6) provides authority for the VMS to issue warnings for weather conditions (tsunami are not exclusively mentioned).</p> <p>The Disaster Management Act (2000, D7) includes tsunami under the definition of a disaster and legislates for the development of National Disaster Support Plans for each kind of disaster (including tsunami) under which agency responsibilities should be defined.</p> <p>The legislation (D7) is under review (July 2009).</p>
Tsunami coordination committee or effort at a National and local level	Partially	<p>Nationally - the NDC is established under the National Disaster Act (2000) (D8). Beneath the NDC is the Disaster Risk Management Task Force. This is a working group looking at risk management and working on development of Vanuatu's DRM NAP (D3) and review of Vanuatu's national disaster plans (D1/D2).</p> <p>Locally – each of the six provinces has a disaster committee (not legislated in the Act, D7). The NDC encourages the provinces and villages to do planning but this is not currently successful.</p> <p>No specific tsunami working groups were identified.</p>

Key Component	Rating	Comment
Authority, Coordination and NGO Role (Continued)		
Agency responsibilities clearly defined	Partially	<p>The National Disaster Act (2000, D7) legislates the requirement for development of a National Disaster Plan to “provide for nationally coordinated actions between government and non-government agencies in the prevention of, preparation for, response to and recovery from disasters”.</p> <p>The Vanuatu National Disaster and Emergency Response Plan (1987) has recently been reviewed (including review of emergency response at the provincial level) to form the Vanuatu Disaster Risk Reduction and Disaster Management Arrangements (D2, 2008). The reviewed arrangements are currently with the Ministry of Internal Affairs and the Prime Ministers office for approval (as at 25 August 2009).</p> <p>The Act (D7) also legislates for development of a “National Disaster Support Plan for each kind of disaster”. These plans are to be developed to outline key agency responsibilities in the case of a disaster. Although tsunami is mentioned in the Act (D7) the workshop did not record that a National Disaster Support Plan exists for tsunami at present.</p> <p>Each provincial council and the municipal council (if any) must produce a Provincial Disaster Plan under the Act (D7). This is ad-hoc at present.</p>
NGOs have a defined role in tsunami warning dissemination, preparedness and awareness and emergency response	Yes	<p>Three branches of the Red Cross and Peace Corps (around 100 volunteers) can assist in informing the community of warnings.</p> <p>World Vision and the Red Cross run disaster awareness community based meetings. The Red Cross is involved in the maintenance of emergency equipment and disaster response teams.</p> <p>CARE International is currently undertaking work directly at the community base level.</p> <p>The Vanuatu Christian Council of Churches is also working through the church network to provide assistance in village disaster plans in terms of vulnerability and risk assessment.</p> <p>Developing a strategic direction for NGOs Peace Corps and Red Cross, so that these organisation can coordinate activities with government.</p>
International and Regional Cooperation		
Country represented at an international and regional level to aid cooperation in tsunami warning and mitigation efforts	Partially	<p>Vanuatu is currently not a member of the IOC. However, Vanuatu is involved with the ICG/PTWS and the Southwest Pacific Working Group.</p> <p>Vanuatu has formed a number of partnerships with international and regional organisations to link into scientific studies, warnings, training and response.</p>

Key Component	Rating	Comment
Priorities		
Priorities established for implementation of tsunami warning and mitigation system at a National level	Yes	<p>Vanuatu's DRM NAP (D1) and associated implementation and business plans outline key actions for strengthening disaster risk management in Vanuatu in general. A priority list specific to tsunami was established through the Tsunami Capacity Assessment Workshop and is summarised below:</p> <ul style="list-style-type: none"> • Review of plans at all levels; • Ensure NDMO, other agencies and coordination centres are adequately resourced; • Explore opportunities to improve dissemination of warnings; • Improved communication between stakeholders to gain accurate assessment data (during event); • Mapping potential risk areas; • Training and exercising to ensure practical application; and • Improved coordination with and amongst NGOs.
Multi-hazard Approach		
Tsunami warning capabilities are being established within a multi-hazard framework	Yes	<p>Vanuatu DMR NAP (D3) is a good example of the all-hazards approach being taken in Vanuatu. The Disaster Risk Reduction and Disaster Management Arrangements (D2 draft 2008) and Act (D7) also take an all-hazards approach. Vanuatu is working towards co-location of Geo-Hazards Unit, NDMO and VMS. The building is not yet complete (as at July 2009).</p>
Research Expertise		
Active research is being undertaken within the country for seismology and tsunami to strengthen the tsunami warning and mitigation system	Partially	<p>A 2-3 year French research project is underway titled "Eruptive dynamics of volcanoes and seismic cycle in the Vanuatu Arc".</p> <p>Nationally, the Geo-Hazards Unit working with the Lands Department and VMS conduct research and develop products and services that could strengthen the tsunami warning and mitigation system in Vanuatu.</p> <p>A number of international research projects have been undertaken in Vanuatu (for example, refer D35).</p>
Tsunami monitoring infrastructure		
Existence of seismograph stations and integration of real time data from these stations into the tsunami warning process	Partially	<p>A network was in operation but has fallen into disrepair after fire in the Geo-Hazards Unit. Previously three stations were available. One station was destroyed in fire. The re-establishment of this network is still being undertaken.</p> <p>Vanuatu signed an agreement with the Chinese in 2007 for a seismic network upgrade. Vanuatu has proposed five broadband and five shortband stations and is awaiting a response on this proposal (as at February 2009).</p>

Key Component	Rating	Comment
Tsunami monitoring infrastructure (Continued)		
Existence of sea-level stations and integration of real time data from these stations into the tsunami warning process	Yes	Port Vila and Luganville sea-level stations provide real-time data to VMS into the tsunami warning process.
Sharing of seismic and sea-level data internationally to facilitate improvement of PTWC tsunami messages for the region	Partially	<p>The seismic data is currently only available for research purposes through an French IRD project and as such there is no real-time data available, to share internationally - although it is provided to the partner agency (Vanuatu Geo-Hazards Unit) in-country in real time but this is not fed into the national warning process.</p> <p>Sea-level data is shared internationally through the Global Telecommunications System (GTS).</p>
Warnings		
Nation receives PTWC messages	Yes	VMS receive the PTWC messages via GTS, PTWC web site, Fax, EMWIN (Emergency Managers Weather Information Network), SMS Text from PTWC to the Director of the VMS. No back-up agency receives the messages.
24/7 operational staff at warning receipt and dissemination location	Partially	<ul style="list-style-type: none"> • VMS operates 18 hours per day – 0300-2100. VMS at the Airport is 24/7 and will alert outside hours of VMS office. On call arrangements exist in six hours downtime. • NDMO are only 24/7 in a disaster. • The Geo-Hazards Unit is not 24/7 (are developing operating procedures). <p>It was noted that on the completion of the new VMS building that it will also incorporate the Geo-Hazards Unit as well as NDMO and facilitate a stronger working relationships. It was also noted that the Geo-Hazards Unit's Business Plan has strategies to provide a 24/7 operational capability.</p>
Disseminate national tsunami warnings as guided by a Standard Operating Procedure	Yes	VMS issue public warnings after signoff from the Director of VMS and Director of Geology and Mines. This only applies in practice to tropical cyclones and not tsunami due to the short time frame. VMS have Tsunami Procedures (draft) and Tropical Cyclone Procedures. Warnings provide general public safety advice messages and are geographically broad. NDMO is responsible for more detailed public advice. Cancellations are issued by VMS based on PTWC advice.
System redundancies in place for receipt of PTWC messages and dissemination of National warnings	Yes	The Director VMS currently receives warnings via SMS. There is also limited back-up from EMWIN.

Key Component	Rating	Comment
Warnings (Continued)		
Redundant 24/7 methods available for dissemination of warnings to community (e.g. public radio, sirens etc.)	Partially	Fax, email, Radio Broadcasts (Radio Vanuatu), TV, Peace Corp and Red Cross Satellite Phones (only switched on as needed), Tropical Cyclone Community Alert Beacon (currently inoperable but could be used for tsunami if serviceable), community gongs (potential method of warning). Opportunity to enhance local knowledge to self evacuate based on natural warning signs.
Effective warning dissemination to remote communities	Partially	Limited by lack of communications infrastructure. In addition to methods above, messages would be faxed to Province Offices (7.30am - 4.30pm) and NDMO would call Police in Provinces via High Frequency (HF) radio network (Police Stations are not 24/7 and have similar hours to Province Offices), Radio Vanuatu also used (limited unless you have the appropriate receiver). Provinces then to disseminate (exercises showed limitations). VMS has been accepted as one of the countries to receive the 1st Pilot Deployment of the RANET Chatty Beetle (as at 16 March 2009).
Communications coverage of whole country that is effectively utilised for the dissemination of tsunami warning messages	No	Limited by technical capacity and knowledge to use systems. Mobile phone network currently does not have the capacity to broadcast SMS to the whole country – currently approximately 80%. Radio Vanuatu (limited unless you have the appropriate receiver).
Issue of marine tsunami warnings and guidance for vessels, harbours and ports	No	Not specifically. VMS has an email list for current coastal warnings that could be used to email tsunami warnings in the future to specific marine risk groups.
Emergency Response and Evacuation		
Disaster preparedness and emergency response system has been reviewed and opportunities for improvement and training identified	Yes	<p>Vanuatu National Disaster and Emergency Response Plan (1987) has recently been reviewed (including review of emergency response at the provincial level) to form the Vanuatu Disaster Risk Reduction and Disaster Management Arrangements (D2, 2008). The reviewed arrangements are currently with the Ministry of Internal Affairs and the Prime Ministers office for approval (as at 25 August 2009).</p> <p>Vanuatu DRM NAP (D3, 2006 - 2016) and associated implantation and business plans exist. These documents guide disaster risk reduction and disaster management strategy in Vanuatu.</p> <p>There is no current capacity development or training relating to emergency response to tsunami specifically coordinated by the Government.</p>

Key Component	Rating	Comment
Emergency Response and Evacuation (Continued)		
Tsunami emergency response, evacuation and recovery plan exists	Partially	The reviewed Vanuatu Disaster Risk Reduction and Disaster Management Arrangements (D2, 2008) and legislation (D7), establishes the broad all hazards framework. The new plan makes mention of tsunami. It is intended that a tsunami plan will be produced following the Vanuatu Disaster Risk Reduction and Disaster Management Arrangements (D2, 2008) review. There are ad hoc operations centres and emergency management structures at the local level.
The designated agency for evacuation is identified and have authority by law	Yes	The Police Service is responsible for coordinating evacuations. Fire Service and communities (NGOs and Red Cross) are responsible for assisting the Police Service. NDMO is responsible for coordinating the identification of evacuation centres and informing the affected communities of their location. Legislation – the Disaster Management Act (D7, 2000) establishes the ability for an emergency officer to direct people to evacuate.
Plans have been made for safe evacuation of population centres including aspects such as maps, routes and signage	No	Not for tsunami, however some work has been completed for Volcanoes. Some tsunami studies have been completed that could assist in this process. The workshop agreed that signage would be useful.
Procedures are tested and exercised to improve the response through better planning and preparedness	Partially	Partially but not on a regular basis. Participated in Exercise Pacific Wave 2006. The exercise involved the Geo-Hazards Unit, VMS and NDMO. As a consequence of this exercise recommendations were made relating to tsunami (See Geo-Hazards Unit Presentation, P3, Appendix 1). NDMO is responsible for providing technical support to assist in the development and conduct of exercises to test national disaster support plans.
Land use policies and building codes are in place to mitigate against the tsunami hazard	No	The building code is in draft and not endorsed by cabinet as yet. Some small walls constructed of coral boulders and mangrove planting has been conducted for coastal protection in some areas.

Key Component	Rating	Comment
Tsunami hazard, vulnerability and risk		
Completion of studies to assess the tsunami hazard in the country or Region	Partially	<ul style="list-style-type: none"> Some tsunami simulations have been developed (Geo-Hazards Unit in cooperation with GeoForschungsZentrum Potsdam (GFZ), SOPAC and GA). GA has completed a preliminary and probabilistic tsunami hazard study for the Southwest Pacific (D26, D27). Some work has been completed regarding assessment of sea-level rise (mainly in regard to Climate Change). Post tsunami surveys have been completed of the 1999 event (refer D37). Probabilistic Seismic Hazard Assessment for Vanuatu was completed by GFZ in collaboration IRD and SOPAC (D35). Inundation modelling was completed for Port Vila and Mele (Vasily Titov, National Oceanic and Atmospheric Administration (NOAA) Pacific Marine Environmental Laboratory, USA, in conjunction with Stan Goosby of the Pacific Disaster Centre (PDC), Hawaii, USA, as part of the SOPAC Port Vila Pacific Cities project). The Geo-Hazards Unit is responsible for identifying tsunami hazard and risk.
Local risk assessments have been completed for at risk communities	No	Refer above.
Adequate data exists and local inundation modelling has been completed for population centres	Partially	<ul style="list-style-type: none"> Some appropriate bathymetry and data exists that is held by the Geo-Hazards Unit, SOPAC and the Lands Department. At the time of the workshop the Lands Department were conducting a topographic data collection project. Modelling capability planned in-country and the Geo-Hazards Unit will appoint and officer.
Public and stakeholder awareness and education		
Measures have been taken to ensure the public understand and take action in the event of a tsunami warning being issued	Partially	<p>Not specifically in relation to warnings in Vanuatu but general education programs exist. Refer below.</p> <p>VMS has conducted an assessment on delivering materials on cyclone, climate change, El Nino. Concentrated on effectiveness of awareness mediums (D21).</p>

Key Component	Rating	Comment
Public and stakeholder awareness and education (Continued)		
Community level education and preparedness programs exist tsunami	Partially	<p>Education is ongoing since 2000. World Disaster Day, World Meteorological Day, World Environment Day events. These have been conducted around provinces. Aim is to provide disaster awareness for all hazards. Provision of methods brochures and posters – most effective was PowerPoint presentations. Target audience – schools, teachers vulnerable communities. They have covered all of Efate and some other provinces. No specific budgets – comes from individual agencies. Cyclone booklet produced. Strategic Engagement Plan – managed by Australian Red Cross on behalf of AusAID with a focus on disaster risk reduction and response – conducted in Vanuatu, Papua New Guinea, Fiji and Solomon Islands. It was a three year project. In process of reviewing it for a further three years</p> <p>At the time of the workshop a project was underway to collect tsunami knowledge and legends.</p> <p>Disaster awareness is not formally included in the school curricula.</p>
Training programs for the National media exist for natural hazard and tsunami	No	Not specifically for tsunami.

5.2. Case Study – 2 April Solomon Islands Tsunami

On at 7.39am on 2 April 2007 local time (1 April 2007 20:39 UTC) a Mw 8.1 earthquake occurred along the South Solomons subduction trench. This earthquake generated a tsunami which impacted upon the Western and Choiseul Provinces of the Solomon Islands, killing 52 people and causing significant damage. This event was used as a case study throughout the tsunami capacity assessment process in Vanuatu. The aim of this case study was to gain an understanding of the operation of the system in a real time event.

In Tsunami Bulletin Number 002 issued by PTWC at 21:32UTC, Vanuatu was placed under a warning. This warning was maintained until Tsunami Bulletin Number 008 cancelled the warning at 04:05 UTC (2nd April). The event was detected in Vanuatu on the Port Vila gauge (refer Figure 4).

For this event Vanuatu received the international tsunami message from the PTWC and as a result issued 4 bulletins starting from 8.30am and the last bulletin at 3:00pm. The national warnings issued advised the community to evacuate. The public response to this warning was mixed. Around Port Vila little action was taken by the public whilst in other areas communities evacuated to higher ground until an all clear was issued. NDMO and key agencies were informed (these and other stakeholders such as businesses are included on a VMS distribution list). VMS also conducted a radio interview at the time.

At the time Vanuatu had one seismic station from which data was received but could not be analysed. It was noted that the Geo-Hazards Unit does not have a 24/7 capability and as such check the data each morning.

In terms of detecting and measuring sea-level changes, the Vanuatu sea level gauge provided six minute time intervals for reporting data at the time on a dedicated personal computer which is separate from the Bureau Registered User Website.

Vanuatu did not have a national tsunami response plan in place at the time of this event. In general, there appeared to be conflicting messages communicated throughout the community and community response to the event was confused as some evacuated and some did not.

5.3. Strengths, Opportunities for Improvement and Recommendations to Progress the Tsunami Agenda in Vanuatu

Based on the discussions during the workshop with in-country participants and the supporting documentation collected during the visit, the visiting team, in consultation with Tsunami Capacity Assessment Workshop participants formulated the following strengths, opportunities for improvement and recommendations under key topics which they believe will progress the tsunami agenda in the Vanuatu. These are outlined in Table 4.

Table 4 – Strengths, opportunities for improvement and recommendations under key topics

5.3.1. Governance and Coordination	
Strengths:	Opportunities for Improvement:
<ul style="list-style-type: none"> • Strong commitment to build a robust system in a spirit of cooperation. • Disaster risk reduction appears in the Priorities and Action Agenda and the DRM NAP of Vanuatu (for all hazards including tsunami). • Excellent relationship between the Geo-Hazards Unit, NDMO and VMS – technical knowledge available. • DRM NAP exists as a framework and demonstrates Government commitment. • National Disaster and Emergency Response Plan has been vigorously reviewed (with Ministry of Internal Affairs and the Prime Ministers office for approval (as at 25 August 2009). • Arrangements and practices for tsunami warning through identified focal agency VMS. • Physical amalgamation of the Geo-Hazards Unit, NDMO and VMS. • The Minister for Internal Affairs is responsible for DRM arrangements in Vanuatu. • The National Disaster Committee exists. Under this committee is the Disaster Risk Management Task Force. This group has primarily been tasked with development of the Vanuatu DRM NAP and review of the National Disaster and Emergency Response Plan. 	<ul style="list-style-type: none"> • No formal agreement (legislation) in place on which agency is responsible for tsunami warning. • No tsunami response plans. • Limited resources – the Geo-Hazards Unit only has 3 staff. • No effective 24/7 operation – 6 hour gap. • VMS SOPs could be further enhanced. • Provincial and community disaster risk management arrangements require strengthening. • The requirement for provincial disaster plans is legislated (D7) but not successfully implemented to date.

*Governance and Coordination (Continued)***Recommendations:**

1. Ensure the current initiatives to approve and implement the Vanuatu Disaster Risk Reduction and Disaster Management Arrangements continue to establish a robust planning framework for all aspects of the Tsunami Warning System within Vanuatu as well as other hazards.
2. Review of the National Disaster Management Act (2000) and ensure consistency between this and other Acts. Include legislation regarding the establishment of emergency management structures at the provincial and community level which are responsible for emergency planning and operational readiness. Also review the legislation regarding monitoring and warning for tsunami and other hazards.
3. Incorporate tsunami considerations into working groups established under the Vanuatu National Disaster Risk Reduction and Disaster Management Arrangements (D2, 2008 working draft) on which key agencies and at-risk communities are represented. This will ensure tsunami risk assessment, planning, community education and capacity development considerations and activities are undertaken within a multi-hazard context.
4. That through the implementation of the Vanuatu Disaster Risk Reduction and Disaster Management Arrangements and DRM NAP particular attention is paid to the development of strong links between activities at the national, provincial and local level.
5. Incorporate the benefits of implementation of improvements in the tsunami warning system across all hazards.
6. Pursue the strategies identified in the Geo-Hazard Unit's Business Plan to facilitate the development of a 24/7 operational capability for the Geo-Hazard Unit in the new VMS building.
7. That VANGO be formally established as the primary national focal point for NGOs in terms of disaster management and risk reduction activities.
8. That emergency plans at national, provincial and local levels be developed and these plans should contain detailed arrangements for each of the threats related to Vanuatu including tsunami. The plans should detail and formalise warning systems in place and the preparation of this plan should include the production of evacuation maps and community consultation. When completed plans should be made available to the public and evacuation maps displayed in prominent locations within communities.
9. That all agencies involved in tsunami warning and response develop SOPs consistent with the Vanuatu Disaster Risk Reduction and Disaster Management Arrangements. These procedures should contain details about each agency's operational response to tsunami. The SOPs should formalise points of contact between each relevant agency in the warning system in all hours of operation and include mechanisms to communicate with other government departments, NGOs, Red Cross/Peace Corps and the community.

5.3.2. Regional and International Coordination

Strengths:	Opportunities for Improvement:
<ul style="list-style-type: none"> • Well developed regional and international network with working partnerships. • Linkages with PTWC. • Good links with nearby Pacific countries. • Involved with the ICG/PTWS and the Southwest Pacific Working Group. 	<ul style="list-style-type: none"> • Seek outside assistance to enhance system overall. • Develop link with IRD. • Working together with advance institutions and warning centres. • Not a member of IOC.
Recommendations:	
<ol style="list-style-type: none"> 10. Continue the moves towards IOC Membership and development of linkages with IRD. 11. Continue active participation in the Southwest Pacific Tsunami Working Group (WG5) of the ICG/PTWS, Regional Meteorological Service Directors meeting and the Pacific Platform for Disaster Risk Management meetings, engaging VMS, the Geo-Hazards Unit and NDMO in these forums. 12. That those Tsunami Capacity Assessment recommendations that are common across a number of Pacific Island Countries be made available to SOPAC and other regional and international organisations for consideration. 	

5.3.3. Research Expertise

Strengths:	Opportunities for Improvement:
<ul style="list-style-type: none"> • The Geo-Hazards Unit, Lands Department and VMS have some capacity to conduct or partner research that could enhance tsunami warning and mitigation systems in Vanuatu. 	<ul style="list-style-type: none"> • Access of knowledge / research.
Recommendations:	
<ol style="list-style-type: none"> 13. Actively cooperate and seek to develop partnerships with universities and regional and international agencies that can assist with conducting scientific research and technical capacity building in Vanuatu with regards to all facets of tsunami management. 14. Actively pursue the acquisition of data from previous and future research projects conducted in country and develop a protocol to do this. 	

5.3.4. Tsunami Monitoring Infrastructure

Strengths:	Opportunities for Improvement:
<ul style="list-style-type: none"> • Technical support capability exists in-country – Geo-Hazards Unit / NDMO. • Vanuatu signed an agreement with the Chinese in 2007 for seismic network upgrade. Vanuatu has proposed five broadband and five shortband stations and is awaiting a response on this proposal (as at February 2009). • Port Vila and Luganville sea-level stations provide real-time data to VMS into the tsunami warning process. 	<ul style="list-style-type: none"> • No robust internal detection system for – earthquake and tsunami monitoring exists. • Real-time seismic network is in disrepair and data is not used real time by Vanuatu or shared internationally in real time. • Technologies require improvement.
Recommendations:	
<p>15. The Geo-Hazards Unit continue to pursue development of a robust and sustainable national seismic network (including training of the maintenance and operational use of data) and promote seismic data sharing internationally and with neighbouring countries in the region.</p>	

5.3.5. Tsunami warnings

Strengths:	Opportunities for Improvement:
<ul style="list-style-type: none"> • A well-exercised weather warning service exists (Tropical Cyclones) run by skilled staff. • Tsunami warnings have been issued and system has been exercised. • PTWC messages regularly arrive through a variety of communications mediums. • On the completion of the new VMS building it will also incorporate the Geo-Hazard Unit as well as NDMO. • The Geo-Hazard Unit's Business Plan has strategies to provide a 24/7 operational capability. • VMS has tsunami procedures. 	<ul style="list-style-type: none"> • No back-up agency for VMS exists to receive and distribute tsunami warnings. • Only agency that is 24/7 is the VMS Airport Office. • Tsunami procedures are limited. • No integrated warning mechanism in place for tsunami. • Training required for technical staff. • Upgrade existing RANET. • 'No Threat' messages are not issued to the Vanuatu community to inform them when not to be concerned.
<p>Recommendations:</p>	
<ol style="list-style-type: none"> 16. VMS continues to develop strong capability to respond to the tsunami threat through the establishment of 24/7 operations based on strong procedures developed with stakeholders. In the short term the response of 24/7 staff at Airport should be formalised. 17. VMS investigate use of available scientific data and tools (deep ocean tsunami models, sea level data and travel time software) to assist in localising the threat to Vanuatu and incorporate use of these tools into tsunami SOPs. 18. VMS obtain access to a tsunami deep ocean model scenario database to assist in determining threat levels to Vanuatu and inform appropriate warning decisions. Adequate ongoing training to use this database would be required. 19. Incorporate into tsunami SOPs the issuing of 'No Threat' messages to the community for tsunami that will not impact on Vanuatu or earthquakes that do not have the potential to generate tsunami. This will avoid misinterpretation of media and international family information. This will also test the system and enhance community awareness when there is a long time between events. 20. That improved warning dissemination methods be investigated including evaluation of different methodologies which would best suit the Vanuatu context, including community based and traditional methods. Examples include: <ol style="list-style-type: none"> a. The suitability of SMS be investigated as a means to complement other dissemination methods; b. Communicating with remote communities including the use of sirens, drums, gongs; c. If full coverage is available from Radio Vanuatu, transmission options for automatic warning tones in remote communities exist; d. As availability/affordability grows, the internet be investigated as a means to deliver up to date warnings and educational information to the community; e. Formats used to disseminate warning information be flexible enough to meet the needs of a wide range of users and delivery mechanisms; f. Establishing links with NGOs, the Red Cross/Peace Corps to assist the dissemination of warnings; and g. Use of the mobile phone network web access. 	

*Tsunami warnings (Continued)***Recommendations (Continued):**

21. That all aspects of the warning system are exercised regularly and in a structured way; both within Vanuatu and by taking part in international exercises to ensure that the response to tsunami warnings is effective at all times.
22. Building on lessons learned from the Tropical Cyclone Warning System, that Vanuatu investigate the development of contingency plans that allow the issue of public warnings from another country and/or a back-up agency in country (to receive warnings from PTWC and disseminate nationally).

5.3.6. Communications**Strengths:**

- Internet backbone robust with redundancies. Potential wireless internet with Digicel through GPRS.
- Peace Corp and Red Cross have satellite phones (only switched on as needed).
- PSAT is a potential future option for seismology project.
- Vanuatu operate EMWIN, RANET, ISCS (International Satellite Communications System) (although not operable at time of the workshop), GTS, telephone and fax.
- Community gongs and drums are a potential method of warning.
- Vanuatu has - Radio Vanuatu Amplitude Modulated (AM) 1125 (6am to 11.15pm), Capitol FM107 (6am to noon), Frequency Modulated (FM) 98 (6am to 11.15pm), Radio New Zealand International.
- A number of Vanuatu agencies operate HF radio. Health (have HF at remote locations clinics), Agriculture, Forestry, Provincial Councils, Peace Corp, Airports Vanuatu, Police (also use Very High Frequency (VHF) in Port Vila). VMS has RANET HF e-mail.
- Mobile phone system exists. With Digicel – improved potential for broadcast SMS – 80-85% coverage.
- Marine warnings issued through e-mail, HF and VHF marine radio channels. NDMO use HF frequencies to warn shipping.
- VMS has been accepted as one of the countries to receive the 1st Pilot Deployment of the RANET Chatty Beetle (as at 16 March 2009).

Opportunities for Improvement:

- Vanuatu radio is limited in the more remote areas unless you have the appropriate receiver. It is also not 24/7.
- Mobile phone network currently does not have the capacity for broadcast SMS and does not cover whole country – currently approximately 80-85% coverage. Coverage is limited to Port Vila, Tanna (West only 5km radius), Luganville, Ambae (East only) with no to limited coverage in remote communities.
- Enhance links between technical resources and communities are required.
- Enhance communication coverage required. For example, poor radio coverage exists.
- Potential to enhance use of satellite phones. No central database of satellite phone numbers.
- Limited by technical capacity and knowledge to use systems and a lack of communications infrastructure.
- One telecommunications company.

Communications (Continued):**Recommendations:**

- 23.** That the Geo-Hazards Unit, NDMO and VMS operations be enhanced to allow for the 24/7 receipt of tsunami information and activation of tsunami response operations via redundant communications means including an SMS alert from the PTWC and that the key individuals within these agencies be identified to receive the SMS alert.
- 24.** That any planning for a future warning service take into account the expanding capabilities delivered by anticipated radio and mobile telephone coverage.
- 25.** Develop strategies to enhance the dissemination of warnings to all communities through the use of satellite phones.
- 26.** VMS and the NDMO to develop formal MOUs with radio stations regarding the broadcast of emergency information including agreements regarding broadcasting of warning information outside normal hours of operation.
- 27.** Investigate the feasibility of current satellite technology to alert remote communities of tsunami warnings including pursuing the pilot trial of the RANET Chatty Beetle.

5.3.7. Tsunami Emergency Response (including evacuation)

Strengths:	Opportunities for Improvement:
<ul style="list-style-type: none"> • The Vanuatu community is experienced at preparing for, and responding to disasters. • Vanuatu Disaster Risk Reduction and Disaster Management Arrangements are reviewed and ready for approval (as at 25 August 2009) (D2). • Police are the nominated agency responsible for coordinating evacuations supported by Fire Service and NGOs. • Active NDMO established under the National Disaster Act (D7, 2000). • Mandate for evacuation using “force as reasonably necessary” is outlined in the Act (D7). • The Act (D7) legislates for development of a “National Disaster Support Plan for each kind of disaster”. • Some international tsunami exercises have been completed. 	<ul style="list-style-type: none"> • No evacuation plans exist for tsunami. • Limited hazard specific planning exists for tsunami. • The requirement for provincial disaster plans is legislated (D7) but not successfully implemented to date. • There are only ad hoc operations centres and/or emergency management structures at the local level.
Recommendations:	
<ol style="list-style-type: none"> 28. Complete, approve and implement a tsunami “disaster support plan” under the Vanuatu Disaster Risk Reduction and Disaster Management Arrangements once approved. Include consideration of critical infrastructure and lifeline support facilities. 29. That the response to any exercises, real events or near-event is reviewed with a Lessons Learned Workshop and the results be made available to all stakeholders and accountability for improvements is delegated and followed up on. 30. That plans be developed that recognize public broadcasts as a vital part of the preparedness, response and recovery stage following a disaster and that this is captured in MOUs with radio stations regarding the broadcast of emergency information. 31. That information systems are established to enable emergency response personnel to access data that could potentially assist in response and recovery in a real event (e.g. GIS layers of critical infrastructure). These information systems should also have the capability to adequately record critical event-based information and that this is shared across agencies. 32. That NDMO facilities located within the new VMS building, include enough resources and space for the coordination of operations and the display of critical information during emergencies. 	

5.3.8. Tsunami Hazard, Vulnerability, Risk and Mitigation

Strengths:	Opportunities for Improvement:
<ul style="list-style-type: none"> • Post tsunami surveys have been completed of the 1999 and 2002 Vanuatu tsunami (for example, D37, D32). • Seismic hazard mapping for all of Vanuatu has been completed (D35). • Some tsunami simulations / modelling have been completed. • A preliminary and probabilistic tsunami hazard study for the Southwest Pacific has been completed, including Vanuatu. • Some small walls constructed of coral boulders and mangrove planting has been conducted for coastal protection in some areas. • Some bathymetry and topography data exists. 	<ul style="list-style-type: none"> • No comprehensive tsunami risk assessment and management study has been completed to feed into a national tsunami management strategy and hazard mapping. • Planning needs to include an assessment of the impacts of works near the coastal interface (for example, sand excavation) and the natural hazard risk potential for new developments. • Building code is in draft only. • Inventory of bathymetry and topography data and central storage of this information for possible further future tsunami inundation modelling.
Recommendations:	
<ol style="list-style-type: none"> 33. Use the tsunami hazard studies that have been completed for the Southwest Pacific Nations to date, historical tsunami records and studies, earthquake hazard studies, existing tsunami modelling, deep ocean tsunami models and topography data to identify low-lying communities which may be prone to tsunami impacts from all likely tsunami sources and produce a suit of hazard maps. Commence tsunami mitigation (structural and non-structural management options), response and evacuation planning using local knowledge. 34. Conduct an inventory of geospatial data available for tsunami and multi-hazard risk assessments, modelling and mapping of populated areas. 35. Acquire the necessary baseline data for populated areas to fill identified gaps as part of a multi-hazard mapping activity. 36. Investigate possible future options for further inundation modelling for prioritised communities. 37. Investigate the current status of volcano monitoring within Vanuatu and evaluate the tsunamigenic potential of major volcanoes and feed this into tsunami plans. 38. That government planning includes an assessment of the impacts of works near the coastal interface (for example, sand excavation) and the natural hazard risk potential for new developments. 	

5.3.9. Public and Stakeholder Awareness and Education

Strengths:	Opportunities for Improvement:
<ul style="list-style-type: none"> • A strong community at the local level able to call on traditional and local knowledge. • Good communication within communities. • Existing natural hazard community awareness programmes that can be built upon for tsunami. • Evaluation of successful education mediums for rural communities has been completed. • Project to collect tsunami knowledge and legends. 	<ul style="list-style-type: none"> • Lack of tsunami awareness in the community and lack of programmes planned to address this. Opportunity to make the community aware after events. • Limited training of local level response teams. • Standardised information, training and reporting required. • Opportunity to enhance local knowledge to self evacuate based on natural warning signs. • No media training programmes.
Recommendations:	
<ol style="list-style-type: none"> 39. That the responsible national working group, in coordination with NDMO and other key government agencies, NGOs, Red Cross/Peace Corps and donor organisations establish a comprehensive tsunami public awareness program based on risk where possible. The programme should aim to improve the awareness and preparedness of the Vanuatu population by considering the production of education material and delivery based on proven methods to the Vanuatu community in multiple languages. 40. Because local tsunami pose a significant threat to Vanuatu ensure that environmental cues are included as a key message when developing and delivering public awareness campaigns. 41. In the short term community education programs could make use of existing generic tsunami education material available through SOPAC and delivery strategies such as National Disaster Awareness Week and schools programs. This material could also be made available to NGOs, Red Cross/Peace Corps and donor organisations for distribution amongst at-risk communities. 42. To complement a public awareness program, the establishment of tsunami signage within urban areas should be investigated to assist in the awareness of transient populations such as tourists, including signage in hotels and resorts. 43. That a tsunami capacity development program be developed, including training and exercising for emergency managers, NGOs, Red Cross/Peace Corps and VMS staff and that this be done in a competency-based framework 44. That media outlets be used to assist in community awareness and preparedness campaigns and a multi-hazard media education campaign be developed and delivered to ensure the media are educated on natural hazards, warning and response systems. 45. That work related to capacity building is complemented with resources that assess its ongoing effectiveness. 	

5.4. Additional Workshop Benefits

In addition to this report, additional benefits of the Tsunami Capacity Assessment Workshop in Vanuatu were:

- Facilitation of working relationships between agencies and organisations involved in tsunami warning and mitigation within Vanuatu;
- Exchange of information on National activities and capabilities within Vanuatu;
- Enhanced working relationships between the Vanuatu participants, the Australian Bureau, EMA and SOPAC; and
- Enhanced understanding and appreciation by the assessment team and project of the challenges faced by the Vanuatu communities.

5.5. Next Steps

Vanuatu will receive three key material outcomes from the Tsunami Capacity Assessment project:

1. The completed questionnaire in electronic format with scanned copies of all supporting documentation collected in-country;
2. A comprehensive National Report in a standard format which aims to summaries information collected from the visits and is consumable for non-technically minded recipients (this document); and
3. A copy of the final Regional Report which will outline common themes across the region.

At the agreement of the country project results will be posted on websites such as the Australian Bureau, SOPAC and Pacific Disaster Net.

Once approved by the country the Bureau will facilitate dissemination of reports to regional and international donors and other stakeholders to ensure maximum exposure of results. Contingent on the availability of human and financial resources, the Bureau and project partners will aim to work with potential donors to bring the findings of this project to their attention on a country and regional scale. This will be done to facilitate further capacity development projects being undertaken based on the results of this project. .



6. Annexure

6. Annexure

6.1. Annexure 1 - Record of Participants

Organisation	Position	Title	First Name	Last Name	Postal Address	Telephone	Fax	Mobile	E-mail
Meteorological Services	Director, Permanent Rep to WMO	Mr	Jotham	NAPAT	Private Mail Bag 9054 or 054 Port Vila	678 22331	678 22310	678 57286	jnapat@meteo.gov.vu
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Forecasting	Forecaster		Williams	WORWOR		22432	27414	72800	wbworwor.@meteo.gov.vu
JICA	IT support	Mr.	Yasuma	Harada		22432	27414		Haradamx@hotmail.com
IT & Engineering	PSO	Mr	Simon	BOE					sboe@meteo.gov.vu
Climate Change	OIC, CC coordinator	Mr	Brian	PHILLIPS				44388	piccap@vanuatu.com.vu
Observation	PSO, VANUATU METEOROLOGICAL SERVICE Observer	Mr	Joe	MALA				46350?	jomala@meteo.gov.vu , jsmala@meteo.gov.vu
Climate Services	Manager	Mr	Kaniaha	SALESA		23866			
NDMO	Director	Mr	Job	ESAU	NDMO Office	22932			je-vandis@vanuatu.com.vu

Organisation	Position	Title	First Name	Last Name	Postal Address	Telephone	Fax	Mobile	E-mail
NDMO									-
Min. Internal Affair	DG Internal Affairs	Mr	Johnson	WAPAIAT					-
NDMO	Training & Awareness Officer	Mr	Esrom	MOLISSA	NDMO Office, PMB 9014	22392	24465	71188	emolisa@vanuatu.gov.vu
NDMO	Operation Officer	Mr	Donald	MANSES	NDMO Office, PMB 9014	22465	24465	45413	dmanses@vanuatu.gov.vu
Min. of Lands	DG								-
Lands and Survey	Director, Seismic Cartographer	Mr	Paul	GAMBETA	PMB 9024	22892		63000	plgambetta@vanuatu.gov.vu
Lands and Survey	Surveyor General	Mr	Marfin	SOKOMANN	PMB 024	22892		41261	msokomann@vanuatu.gov.vu
MIPU – Ministry of Infrastructure & Public Utilities	DG MIPU	Mr	Wilson	VUTI					
Dept. Agriculture	Principal Agri. Officer	Mr	Frazer	BULE					
Geology Department/Geo- Hazards Unit	Geo-Hazards Unit Manager	Ms	Esline	GARAEBITI	PMB9001	22907	22213	44850	gesline@vanuatu.gov.vu
Geo-Hazards Unit		Mr	Moris	HARISON					
DESP	Sector Analyst	Mr	Thomas	BANGA					
IRD	Researcher	Mr	Bernard	Pelltier	?? Noumea	49748		49748	Bernard.Pelletier@noumea.ird.re??
Public Health	Health Disaster Focal; Point	Mr	Hmorris	Amos	PMB 9009, Port Vila	22512	25438	43519	Mamos@vanuatu.gov.vu
Environment Unit	Acting Director		Trinison	TARI					
Police	a/ Chief Commissioner		Arthur	CAULTON					
Police	Rep								

VANUATU TSUNAMI CAPACITY ASSESSMENT REPORT

Organisation	Position	Title	First Name	Last Name	Postal Address	Telephone	Fax	Mobile	E-mail
VMF	Rep								
Min. of Education	Director, Public Health	Mr	Len	TARIVONDA	PMB 9009	22512	25438	40700	ltarivonda@vanuatu.gov.vu
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Ports and Harbor	Advisor	Mr.	Morris	Hamish	PMB 2046	22339	22475	42516	
PWD	Acting Director	Mr.	Willie	WATSON					
Foreign Affairs		Mr.	Jason	RAUBANI					
Foreign Affairs	Threats Division	Mr.	Larson	Samuel	PMB 9051	22913	23142	45248	Lsamuel@vanuatu.gov.vu
Fisherman Asso	Secretary	Mr.	Peter	JAMES					
Fisheries Dept.	Acting principle fisheries officer, Marine Biologist	Mr.	Jason	RAUBANI	PMB 9045	23119	23641	42101	jraubani@vanuatu.com.vu
VANGO – Vanuatu Association of Non Government Organsiations	Director	Mr	Henry	VIRA					
VCC	Chairman	Mr.	Uen	ATNELO					
Anglican Church	Rep								
Saint Vinc. dePaul	Rep	Mr.	Lulien	BIRES	B.P. 3420	74741		74741	lucien.bires@refer.org.vu
UNDP/UNV	Disaster Risk Management Specialist	Mr.	Steven	Clegg	Saratamata Village, Ambae Island	61140		61140	

Organisation	Position	Title	First Name	Last Name	Postal Address	Telephone	Fax	Mobile	E-mail
PCV	Rep								
AUSAID Office	Officer	Mr.	Patrick	HAINES					
PEACE-CORP	Program Manager	Mr.	Mark	KALOTAP	PMB 9097	26160	26162	40318	Mkalotap@vu.Peacecorps.gov
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World Vision		Mr.	Simon	BOE					
Red Cross	Head of Delegation								
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VBTC	Radio Vanuatu Manager	Mr.	Samuel	Seiragi	PMB 9049	22999		50015	samtaffb@hotmail.com
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DIGI-CELL	Managing Director								
Trading Post	Journalist	Mr	Royson	WILLIE					
Independent	Journalist	Ms	Evelyne	TOA	PO Box 1555	22200	29991	44454	Deputy.editor@independent.vu

6.2. Annexure 2 – The visiting assessment team

Team Position	Name	Position within Organisation	Organisation	Contact Details
Natural Hazard Warning Expert and Team Leader	Rob Webb	Supervising Meteorologist – New South Wales Regional Forecasting Centre	Australian Bureau of Meteorology	r.webb@bom.gov.au Ph. +61 2 9296 1528 Fax. +61 2 9296 1619 Mobile. +61 4 1725 7113
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Emergency Management Expert	Andrew Gissing	Manager Planning	New South Wales State Emergency Services	Andrew.gissing@nsw.ses.gov.au Ph. +61 2 4224 2270 Fax. +61 2 4226 2167 Mobile: +61 412 107 853
Data Communications Expert	Garry Clarke	International Operations Manager, Meteorological Service of New Zealand Ltd	For the Australian Bureau of Meteorology	Garry.Clarke@metservice.com Ph. +64 4 4700774 Mobile. +64 21 880707

6.3. Annexure 3 – Agenda, Vanuatu Tsunami Capacity Assessment Workshop

DAY 1: Tuesday 22 April 2008				
SESSION 1: OPENING CEREMONY AND INTRODUCTORY PRESENTATIONS				
LOCATION: The Melanesian Port Vila				
CHAIR: Rob Webb, Australian Bureau of Meteorology				
Time	Item	Questionnaire Reference	Duration	Participation
9.00 – 9.30am	Registration / Tea and Coffee	NA	0.5hr	Open
9.30 - 10.30am	Opening Ceremony	NA	1hr	Open
10.30 – 11.00am	Official Opening Morning Tea	NA	0.5hrs	Open
11.00 – 11.30am	Presentation – Visiting Assessment Team Leader <ul style="list-style-type: none"> <i>Introduction to the tsunami capacity assessment project, tsunami and tsunami hazard for Vanuatu and the SW Pacific Region</i> Presenter: Rob Webb and Noud Leenders	NA	0.5hrs	Open
11.30 – 12.30pm	Presentations – Vanuatu Experts <ul style="list-style-type: none"> <i>Tsunami warning and mitigation in Vanuatu</i> Presenter: Ms Esline Garaebiti, Manager, Geo-Hazards Division.	NA	1hr	Open

Time	Item	Questionnaire Reference	Duration	Participation
12.30 – 1.30pm	Lunch	NA	1hr	Open
SESSION 2: ORGANISATIONS, COMMITTEES, LEGISLATION, STRATEGY AND COOPERATION				
LOCATION: The Melanesian Port Vila				
CHAIR: Rob Webb, Australian Bureau of Meteorology				
Time	Item	Questionnaire Reference	Duration	Participation
1.30 – 2.30pm	<i>Focus Groups – Vanuatu's priorities for implementing an effective tsunami warning and mitigation system</i>	Section 4	1hr	Open
2.30 – 3.30pm	Capacity Assessment – Organisations, Committees and Legislation			
	<i>Organisations involved in tsunami warning and mitigation in Vanuatu</i>	Section 2, Part A	1hr	Open
	<i>Tsunami warning and mitigation coordination committees at National, Provincial and Community level in Vanuatu</i>	Section 2, Part B		
	<i>Legislation relevant to tsunami warnings and emergency response</i>	Section 2, Part C		
3.30 – 4.00pm	Afternoon tea	NA	0.5hrs	Open
4.00 – 5.00pm	Capacity Assessment – Strategy, International and Regional Cooperation, All Hazards Approach			
	<i>Disaster risk reduction strategy in Vanuatu</i>	Section 2, Part D	1hr	Open
	<i>International and Regional cooperation for tsunami warning and mitigation in Vanuatu</i>	Section 2, Part E & F		
	<i>All-hazards approach</i>	Section 3		
5.00pm	CLOSE			

DAY 2: Wednesday 23 April 2008**SESSION 3: RESEARCH, MONITORING AND WARNING****LOCATION: The Melanesian Port Vila****CHAIR: Andrew Gissing, New South Wales State Emergency Services, Australia**

Time	Item	Questionnaire Reference	Duration	Participation
9.00 – 9.30am	Setting the Scene: Tsunami Warnings & Communication <i>Presenter: Rob Webb and Garry Clarke</i>	NA	0.5hrs	Open
9.30 – 11.30am	Capacity Assessment – Research, Monitoring, Warning and Emergency Response			
9.30 – 10.00am	<i>Research and development expertise</i>	Section 5	0.5hr	Open
10.00 – 10.30am	Tsunami monitoring including: <ul style="list-style-type: none"> <i>Tsunami monitoring infrastructure (seismic network, sea-level network and utilisation of satellites for data communication)</i> <i>Case Study – Use of this monitoring infrastructure for the 2 April 2007 Solomon Islands Event</i> 	Section 6, Part A, B, C & Case Study – Monitoring Systems	0.5hrs	Open
10.30 - 11.00am	Morning Tea	NA	0.5hrs	Open
11.00 – 1.00pm	Tsunami warning system in Vanuatu including: <ul style="list-style-type: none"> <i>International communication cooperation</i> <i>National tsunami warning centre</i> <i>Receipt of advisories from PTWS</i> <i>Procedures for dissemination of tsunami warnings Nationally, once received from PTWS</i> 	Section 7, Part A, B, C, D, E, F, G, Case Study – Tsunami Advisory Messages and Warnings & Part H	2hrs	Open

Time	Item	Questionnaire Reference	Duration	Participation
	<p><i>Tsunami warning system in Vanuatu <u>continued</u> including:</i></p> <ul style="list-style-type: none"> <i>Issuing warnings for marine vessels, harbours and ports</i> <i>Case Study – Receipt of international advisories and dissemination of warnings nationally for the 2 April 2007 Solomon Islands Event</i> <i>CONCLUSION – Strengths and weaknesses of tsunami warnings</i> 	As above	As above	As above
1.00 – 1.30pm	Lunch	NA	0.5hr	Open
SESSION 4: SITE TOURS				
LOCATION: Various				
CHAIR: NA				
1.30 – 5.00pm	<p>Visiting assessment team tours of sites and facilities important to tsunami warning and mitigation within Vanuatu including:</p> <ul style="list-style-type: none"> Tide gauge 	NA	3.5hrs	Relevant Agencies & Assessment Team

DAY 3: Thursday 24 April 2008**SESSION 5: TSUNAMI EMERGENCY RESPONSE, MITIGATION AND PREPAREDNESS**

LOCATION: The Melanesian Port Vila

CHAIR: Rob Webb, Australian Bureau of Meteorology

Time	Item	Questionnaire Reference	Duration	Participation
9.00 – 9.30am	Setting the Scene: Community Awareness, Capacity Building & Risk Assessment Based Emergency Planning <i>Presenter: Andrew Gissing, Vanessa Coli</i>	NA	0.5hrs	Open
9.30 – 10.30am	Emergency response to tsunami in Vanuatu <ul style="list-style-type: none"> Assessing the capacity of the disaster management system in Vanuatu and identifying training needs Emergency response and recovery plans Evacuation (including evacuation legislation) 	Section 8, Part A, B & C	1hr	Open
10.30 – 11.00am	Morning Tea	NA	0.5hrs	Open
11.00 – 12.30pm	Emergency response to tsunami in Vanuatu <u>continued</u> including: <ul style="list-style-type: none"> GIS use for emergency response Testing and exercising Consideration of critical infrastructure Tsunami mitigation efforts The role of NGOs in tsunami warning and mitigation Case Study – Preparedness and response for the 2 April 2007 Solomon Islands Event 	Section 8, Part D, E, F, G, H & Case Study – Preparedness and Response	1.5hrs	Open

Time	Item	Questionnaire Reference	Duration	Participation
12.30 – 1.30pm	Lunch	NA	1hr	Open
SESSION 6: TSUNAMI HAZARD, VULNERABILITY AND RISK AND COMMUNITY AWARENESS				
1.30 – 5.00pm	Capacity Assessment – Hazard, Vulnerability and Risk Studies and Community Awareness			
1.30 – 2.30pm	<p><i>Tsunami hazard, vulnerability and risk studies in Vanuatu including:</i></p> <ul style="list-style-type: none"> • <i>Post tsunami surveys</i> • <i>Tsunami hazard, vulnerability and numerical modelling studies</i> • <i>Community participation in assessing the tsunami risk</i> 	Section 9, Part A, B, C, D, E, F	1hr	Open
2.30 – 3.00pm	Afternoon Tea	NA	0.5hrs	Open
3.00 – 5.00pm	<p><i>Public and stakeholder awareness and education regarding tsunami in Vanuatu including:</i></p> <ul style="list-style-type: none"> • <i>Assessment of public awareness</i> • <i>The role of public awareness in understanding warnings and taking action</i> • <i>Public awareness and education programs</i> • <i>Media education programs</i> • <i>Tsunami memorials and museums</i> 	Section 10, Part A, B, C, D	2hrs	Open
5.00pm	CLOSE			

Time	Item	Questionnaire Reference	Duration	Participation
DAY 4: Friday 25 April 2008				
SESSION 6: PRESENTATION OF PRELIMINARY ASSESSMENT FINDINGS				
LOCATION: The Melanesian Port Vila				
CHAIR: Rob Webb, Australian Bureau of Meteorology				
10.00 – 11.30am	Preliminary summary presentation from the visiting assessment team – Vanuatu's strengths, needs, preliminary recommendations, priority review and next steps. <i>Presenter: Rob Webb</i>	NA	1.5hr	Open
11.30 – 12.00am	Questions and Feedback from Vanuatu participants on preliminary summary presentation and the assessment process in general.	NA	0.5hrs	Open
12.00 – 12.15pm	ACKNOWLEDGEMENTS AND CLOSE	NA	15mins	Open
12.15 – 1.00pm	Closing Lunch	NA	45mins	Open
1.00 – 4.00pm	Additional site visits (if required by assessment team)	NA	As required	Relevant Agencies & Assessment Team

6.4. Annexure 4 – Supporting Documents Log

Ref.	Document Name	Copy Obtained (Y/N)	Format (H = Hard Copy) (E = Electronic)
D1	Vanuatu National Disaster and Emergency Plan 1987 (outdated)	N	N
D2	Vanuatu National Disaster Risk Reduction and Disaster Management Arrangements 2008 (working draft May 2008 to replace 1987 plan)	Y	E
D3	Vanuatu Disaster Risk Reduction and Disaster Management National Action Plan 2006 – 2016	N	E
D4	Vanuatu Met Service Tsunami Warning Centre SOPs -draft	Y	E
D5	Pacific Wave Exercise Review Report	N	NA
D6	Meteorology Act (2000)	Y	E
D7	National Disaster Act (2000)	Y	E
D8	Environmental Management Act (2002)	Y	E
D9	Telecommunications Act 1989, 1993,2006	Y	E
D10	Paleotsunami Research Project Plan	N	NA
D11	Vanuatu National Action Plan – 3 year implementation Plan	Y	H
D12	Vanuatu National Action Plan – 1 year Business Plan (Developed by Each Department)	N	NA
D13	NDMO SOPs	N	As part of the Draft National Disaster Plan
D14	UNDP project on building disaster resilience in local communities	N	Unavailable to be sourced
D15	Govt of Vanuatu/Govt of Australia MOU	Y	E
D16	Tropical Cyclone exercise evaluation	N	NA
D17	Project plans re. seismology and volcano – geohazards – involves satellite information (Volcano Monitoring Seismic Network)	N	NA
D18	Despatch/telephone lists for Tsunami warnings	Y	E
D19	Contact lists for NDMO in the case of an emergency	N	NA
D20	Tropical Cyclone procedures and lists – Vanuatu Meteorological Service (2007 – 2008)	Y	E
D21	Draft report, presentation etc. on Effectiveness of Rural Awareness 2002	Y	E

Ref.	Document Name	Copy Obtained (Y/N)	Format (H = Hard Copy) (E = Electronic)
D22	Presentations used in education program	N	NA
D23	Strategic engagement plan the Red Cross manage	N	NA
D24	Copies of community preparedness and education programs	N	NA
D25	VMS Annual Work Plans by Section 2008	Y	E
D26	A Preliminary study into the Tsunami Hazard faced by Southwest Pacific Nations	Y	E
D27	Probabilistic Tsunami Hazard Assessment of the Southwest Pacific Nations	Y	E
D28	Article, Tsunami Capacity Assessment of Vanuatu, Page 2, The Daily Post Newspaper 23 April 2008	N	NA
D29	Article, Tsunami Capacity Assessment of Vanuatu, Page 2, The Daily Post Newspaper 24 April 2008	N	NA
D30	Vanuatu : National disaster plan review of November 2004	Y	E
D31	Geospatial data & options for inundation modelling - PIC summary	Y	E
D32	a) Vanuatu 2002 Earthquake and Tsunami Summary – SOPAC b) Vanuatu 2002 Earthquake and Tsunami Preliminary Report – SOPAC	Y	E
D33	Vanuatu 1999 Earthquake and Tsunami – UNDP Assessment	Y	E
D34	Vanuatu NEOC Operations Manual 2004	Y	E
D35	Vanuatu Probabilistic Hazard Assessment Earthquakes	Y	E
D36	Report on Education on Natural Disaster Preparedness for Sustainable Development	Y	E
D37	Numerical modelling of the 26 November 1999 Vanuatu tsunami	Y	E

6.5. Annexure 5 - Definitions

Used in reports for SOPAC Member Countries National Capacity Assessment: Tsunami Warning and Mitigation Systems

Source: United Nations, International Strategy for Disaster Reduction, 2009

Capacity

A combination of all the strengths and resources available within a community, society or organization that can reduce the level of risk, or the effects of a disaster.

Capacity may include physical, institutional, social or economic means as well as skilled personal or collective attributes such as leadership and management.

Capacity may also be described as capability.

Capacity building

Efforts aimed to develop human skills or societal infrastructures within a community or organization needed to reduce the level of risk.

In extended understanding, capacity building also includes development of institutional, financial, political and other resources, such as technology at different levels and sectors of the society.

Disaster

A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources.

A disaster is a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk.

Disaster risk management

The systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters. This comprises all forms of activities, including structural and non-structural measures to avoid (prevention) or to limit (mitigation and preparedness) adverse effects of hazards.

Disaster risk reduction (disaster reduction)

The reduction of disaster risks and adverse impacts of natural hazards, through systematic efforts to analyse and manage the causes of disasters, including through avoidance of hazards, reduced social and economic vulnerability to hazards, and improved preparedness for adverse events

Early warning

The provision of timely and effective information, through identified institutions, that allow individuals exposed to a hazard, to take action to avoid or reduce their risk and prepare for effective response.

Early warning systems include of three primary elements: (i) forecasting of impending events; (ii) processing and dissemination of warnings to political authorities and population; and (iii) undertaking appropriate and timely actions.

Emergency management

The organization and management of resources and responsibilities for dealing with all aspects of emergencies, in particularly preparedness, response and rehabilitation. *Emergency management involves plans, structures and arrangements established to engage the normal endeavours of government, voluntary and private agencies in a comprehensive and coordinated way to respond to the whole spectrum of emergency needs. This is also known as disaster management.*

Geographic information systems (GIS)

Analysis that combine relational databases with spatial interpretation and outputs often in form of maps. A more elaborate definition is that of computer programmes for capturing, storing, checking, integrating, analysing and displaying data about the earth that is spatially referenced.

Geographical information systems are increasingly being utilised for hazard and vulnerability mapping and analysis, as well as for the application of disaster risk management measures.

Hazard

A potentially damaging physical event, phenomenon and/or human activity, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological and biological) and/or induced by human processes (environmental degradation and technological hazards). Hazards can be single, sequential or combined in their origin and effects. Each hazard is characterised by its location, intensity, frequency and probability.

Land-use planning

Branch of physical and socio-economic planning that determines the means and assesses the values or limitations of various options in which land is to be utilized, with the corresponding effects on different segments of the population or interests of a community taken into account in resulting decisions.

Land-use planning involves studies and mapping, analysis of environmental and hazard data, formulation of alternative land-use decisions and design of a long-range plan for different geographical and administrative scales.

Land-use planning can help to mitigate disasters and reduce risks by discouraging high-density settlements and construction of key installations in hazard-prone areas,

control of population density and expansion, and in the siting of service routes for transport, power, water, sewage and other critical facilities.

Mitigation

Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards.

Natural hazards

Natural processes or phenomena occurring in the biosphere that may constitute a damaging event.

Natural hazards can be classified by origin namely: geological, hydrometeorological or biological. Hazardous events can vary in magnitude or intensity, frequency, duration, area of extent, speed of onset, spatial dispersion and temporal spacing.

Preparedness

Activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary removal of people and property from a threatened location.

Prevention

Activities to provide outright avoidance of the adverse impact of hazards and means to minimize related environmental, technological and biological disasters.

Depending on social and technical feasibility and cost/benefit considerations, investing in preventive measures is justified in areas frequently affected by disasters. In the context of public awareness and education, related to disaster risk reduction changing attitudes and behaviour contribute to promoting a "culture of prevention".

Public awareness

The processes of informing the general population, increasing levels of consciousness about risks and how people can act to reduce their exposure to hazards. This is particularly important for public officials in fulfilling their responsibilities to save lives and property in the event of a disaster.

Public awareness activities support changes in behaviour leading towards a culture of prevention. This involves public information, dissemination, education, radio or television broadcasts and the use of printed media, as well as, the establishment of information centres and networks and community and participation actions.

Recovery

Decisions and actions taken after a disaster with a view to restoring or improving the pre-disaster living conditions of the stricken community, while encouraging and facilitating necessary adjustments to reduce disaster risk.

Recovery (rehabilitation and reconstruction) affords an opportunity to develop and apply disaster risk reduction measures.

Relief / response

The provision of assistance or intervention during or immediately after a disaster to meet the life preservation and basic subsistence needs of those people affected. It can be of an immediate, short-term, or protracted duration.

Resilience / resilient

The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures.

Risk

The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human induced hazards and vulnerable conditions.

Conventionally risk is expressed by the notation

Risk = Hazards x Vulnerability

Some disciplines also include the concept of exposure to refer particularly to the physical aspects of vulnerability.

Beyond expressing a possibility of physical harm, it is crucial to recognize that risks are inherent or can be created or exist within social systems. It is important to consider the social contexts in which risks occur and that people therefore do not necessarily share the same perceptions of risk and their underlying causes.

Risk assessment/analysis

A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend.

The process of conducting a risk assessment is based on a review of both the technical features of hazards such as their location, intensity, frequency and probability; and also the analysis of the physical, social, economic and environmental dimensions of vulnerability and exposure, while taking particular account of the coping capabilities pertinent to the risk scenarios.

Structural / non-structural measures

Structural measures refer to any physical construction to reduce or avoid possible impacts of hazards, which include engineering measures and construction of hazard-resistant and protective structures and infrastructure.

Non-structural measures refer to policies, awareness, knowledge development, public commitment, and methods and operating practices, including participatory mechanisms and the provision of information, which can reduce risk and related impacts.

Vulnerability

A set of conditions and processes resulting from physical, social, economic, and environmental factors, which increase the susceptibility of a community to the impact of hazards.

6.6. Annexure 6 - References

- Australian Agency for International Development (AusAID) and Australian Bureau of Meteorology 2006, *Schedule 5 to the Record of Understanding 14304 in relation to cooperation between the Australian Bureau of Meteorology and AusAID for SOPAC Member Countries National Capacity Assessment: Tsunami Warning and Mitigation Systems*, AusAID, Canberra.
- Intergovernmental Oceanographic Commission, a division of the United Nations Educational, Scientific and Cultural Organisation, *Assessment of Capacity Building Requirements for an Effective and Durable Tsunami Warning and Mitigation System in the Indian Ocean, Consolidated Report for Countries Affected by the 26 December 2004 Tsunami*, viewed 2008, <http://ioc3.unesco.org/indotsunami/nationalassessments.htm>
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- Terminology: Basic terms of disaster risk reduction March 2004, United Nations, International Strategy for Disaster Reduction, viewed January, 2007, <http://www.unisdr.org/eng/library/lib-terminology-eng%20home.htm>
- Vanuatu Country Brief – July 2009, Australian Department of Foreign Affairs and Trade, Canberra, viewed August 2009, http://www.dfat.gov.au/geo/vanuatu/vanuatu_brief.html



7. CD Attachment

7. CD Attachment - Supporting Documents

- a. Assessment Questionnaire
- b. Supporting Documents
- c. Presentations

