

WORLD METEOROLOGICAL ORGANIZATION

**RA V TROPICAL CYCLONE COMMITTEE FOR THE
SOUTH PACIFIC AND SOUTH-EAST INDIAN OCEAN**

TWELFTH SESSION

(ALOFI, NIUE, 11 to 17 JULY 2008)



FINAL REPORT

GENERAL SUMMARY OF THE WORK OF THE SESSION

1. ORGANIZATION OF THE SESSION (Agenda item 1)

1.1 Opening of the session (agenda item 1.1)

1.1.1 At the kind invitation of the Government of Niue, the twelfth session of the WMO Regional Association V (South-West Pacific) Tropical Cyclone Committee for the South Pacific and South-East Indian Ocean (XII-RA V/TCC) was held in Alofi, Niue from 11 to 17 July 2008.

1.1.2 The session was opened at 13.00 on Friday, 11 July 2008, with a warm welcome by Mr Sionetasi Pulehetoa, Director of Niue Meteorological Service, and Permanent Representative of Niue with WMO.

1.1.3 On behalf of Mr. Michel Jarraud, Secretary-General of WMO, Mr. Dieter Schiessl, Director, Weather Service and Disaster Risk Reduction Department of WMO, welcomed the participants and expressed the sincere appreciation of WMO to the Government of Niue for hosting the twelfth session of the Committee in Alofi, Niue. He stated that climate change increases the risks of environmental disasters in the tropical cyclone endangered regions. He also informed the Committee that storm surges are now emerging as a critical issue that should be urgently addressed after the recent tropical cyclones “*Sidr*” and “*Nargis*” in the Bay of Bengal, which devastated Bangladesh and Myanmar, respectively. In this connection, he informed the Committee that the Sixtieth session of WMO Executive Council (EC-LX) identified two high priority needs for tropical cyclone affected regions; technology transfer across basins for tropical cyclone forecasting and warnings, and incorporation of “Storm Surge Watch Schemes” in tropical cyclone advisories. He invited the Committee to review the Executive Council decisions with a view of turning these into concrete activities. He also informed the Committee about the WMO disaster risk reduction programme which has resulted in a noticeable improvement in the warning systems in many parts of the world. However, there is still much to be done in this area and WMO gives a high priority to developing and promoting an integrated approach towards strengthening the disaster risk management capabilities in its Strategic Plan 2008-2011 and beyond, adopted by fifteenth World Meteorological Congress (Cg-XIV) in 2007. In this regard, Mr Schiessl appealed to the Committee to respond to that request and commence a review of the Committee’s expected outcomes, deliverables and performance targets. He also stressed that the synergies between the Disaster Risk Reduction (DRR) and the Tropical Cyclone Programme (TCP) activities are indispensable, which should be manifested through closely coordinated initiatives of the programmes related to TCP and DRR in concert with the WMO Regional Programme (RP). Finally, Mr Schiessl underlined the significance of the Severe Weather Forecast Demonstration Project (SWFDP) and encouraged the Committee to give guidance to this project in order to ensure that it receives the necessary support and achieves its expected outcomes to enhance regional capabilities for tropical cyclone preparedness, and emphasized the urgent need to support the Nadi RSMC.

1.1.4 The Premier of Niue, Hon. Toke Talagi welcomed the participants to Niue, with expression of being proud of hosting the meeting. He then mentioned the very strong tropical cyclone “*Heta*” in January 2004, which devastated his country and caused loss of lives, and expressed that lessons were learnt that we should strive to improve and prepare for such natural disasters. He stressed that it is critically important for Niue to strengthen coordination with neighbouring countries in the Pacific region to have a robust early warning system in place. In order to protect properties and lives, and disaster risk management in general, it is a top priority to strengthen coordination in channelling weather warnings between meteorological services, disaster council, governments and local communities. He acknowledged the leadership of WMO in substantially contributing to the protection of lives and properties against natural disasters, to safeguarding the environment, and to enhancing the economic and societal well being of all sectors of society in areas such as food security, water resources and transport. He also acknowledged all delegates travelled to Niue and funding agencies in making the event possible. Finally, he declared the opening of the XII-RA

V/TCC.

1.1.5 The XII-RA V/TCC session was attended by 36 participants from 16 Members of WMO namely: Australia, Cook Islands, Fiji, French Polynesia, Kiribati, Indonesia, Federated States of Micronesia, New Caledonia, New Zealand, Niue, Papua New Guinea, Samoa, Solomon Islands, Tonga, USA and Vanuatu. There were three observers from UNESCO/IOC, SOPAC and SPREP. The list of participants is given in **Appendix I**.

1.2 Adoption of the agenda (agenda item 1.2)

1.2.1 The Committee adopted the agenda for the session as given in **Appendix II**.

1.3 Election of vice-chairman (agenda item 1.3)

1.3.1 Mr Sionetasi Pulehetoa (Niue) was elected unopposed as vice-chairman of the twelfth session of the WMO Regional Association V (South-West Pacific) Tropical Cyclone Committee for the South Pacific and South-East Indian Ocean (XII-RA V/TCC).

1.4 Working arrangements for the session (agenda item 1.4)

1.4.1 The Committee agreed that the session be conducted in one committee as a whole. The Committee also agreed on its working hours with breaks in the morning and afternoon sessions.

2. REPORT OF THE CHAIRMAN OF THE COMMITTEE (Agenda item 2)

2.1 The Chairman presented his report on the main activities and progress achieved since the eleventh session of the Committee (Adelaide, Australia, 4 to 8 May 2006).

2.2 The Chairman noted that several of the delegates from Members were young forecasters attending the session of the Committee for the first time. He welcomed the delegates and reminded them that they represented the future of the Committee and the continued provision of tropical cyclone warning services to the Region V.

2.3 The Chairman reported that over the past two tropical cyclone seasons there had been below average number of cyclones in the Region with 11 cyclones in 2006/2007 season and 13 cyclones 2007/2008 season. Several of these cyclones produced significant impacts on countries within the Region. The most serious was tropical cyclone "Guba", which in its development phase produced very heavy rainfall in Papua New Guinea resulting in serious flooding and landslides. As a result over 200 people lost their lives. This was the most significant loss of life due to a tropical disturbance in the Region for many decades.

2.4 A most pleasing aspect of the past two years was the reactivation of the Tropical Cyclone Warning Centre in Jakarta (Jakarta TCWC), which commenced operations in January 2008 following concerted efforts by staff from the Indonesian Meteorological Service and with considerable assistance from staff of the Australian Bureau of Meteorology. Jakarta TCWC was officially opened on 24th of March 2008 at a ceremony attended by the Chairman of the RA V/TCC.

2.5 The Chairman reported on his involvement in the WMO-led Fact-Finding Mission to Fiji in July 2007 and the various initiatives to ensure the continued viability of RSMC Nadi. One of the main issues for immediate attention is the forecaster staffing situation at RSMC Nadi (*Refer to Section 8.2 for progress on RSMC Nadi*). The Chairman noted the assistance provided by Australia to help maintain forecaster staffing level at RSMC Nadi over the past two tropical cyclone seasons. An important step towards strengthening regional and national meteorological services in Pacific Islands, in particular, the future of RSMC Nadi is the recent review of delivery of weather, climate and extreme events services by a team of experts, led by the Pacific Islands Forum Secretariat (PIFS). A policy document on various options available to the region will be presented to the forthcoming Pacific Island Forum Smaller

Island States (SIS) Leaders' Summit Meeting in Niue in August 2008.

2.6 The Chairman noted the various training initiatives provided over the past two years through the assistance from Australia, France, Japan, New Zealand, USA and WMO. These programmes contributed to the highly effective tropical cyclone warning services provided across the Region (*Refer to Section 6.5 for further information on training activities in the region*).

2.7 Many of the issues mentioned in the Chairman's report are discussed under the relevant agenda items of the meeting.

3. COORDINATION WITHIN THE WMO TROPICAL CYCLONE PROGRAMME (Agenda item 3)

3.1 The Committee was informed that the fifteenth World Meteorological Congress (Cg-XV) and the sixtieth session of the WMO Executive Council (EC-LX) discussed the Tropical Cyclone Programme (TCP) from a broad perspective. Major guidance given from Cg-XV are represented by the following key points:

- 1) To continue to give priority to capacity building, particularly in Small Island Developing States (SIDS) and Least Developed Countries (LDCs);
- 2) To promote cooperation with relevant WMO programmes such as Disaster Risk Reduction (DRR), Public Weather Service (PWS), Marine Meteorology and Oceanography Programme (MMOP), Hydrology and Water Resources (HWR) and Atmospheric Research and Environment Programme (AREP);
- 3) To facilitate participation of hydrologists and DRR experts in the regular sessions of the five WMO tropical cyclone regional bodies; and
- 4) To pursue recommendations from the Sixth International Workshop on Tropical Cyclones (IWTC-VI).

3.2 The TCP activities during the inter-sessional period 2007-2008 were implemented based on this guidance, contributing to the various outcomes of WMO Strategic Plan 2008-2011 and Beyond, in particular:

- 1) Expected Result 1 – Enhanced capabilities of Members to produce better forecasts and warnings; and
- 2) Expected Result 6 – Enhanced the capabilities of Members in multi-hazard early warning and disaster risk reduction and preparedness.

3.3 The Committee noted with satisfaction the achievements and progress made in both the general component and the regional component of the TCP since its eleventh session (Adelaide, Australia, 4-8 May 2006).

3.4 The Committee was also informed that during the inter-sessional period, the fortieth session of the ESCAP/WMO Typhoon Committee was held in Macao, China from 21 to 26 November 2007; the thirtieth session of Hurricane Committee was held in Orlando, USA from 23 to 28 April 2008; and the thirty-fifth session of the WMO/ESCAP Panel on Tropical Cyclones was held in Bahrain from 5 to 9 May 2008. Currently, arrangements are underway for the eighteenth session of RA I Tropical Cyclone Committee for the South-West Indian Ocean, to be held in Lilongwe, Malawi, from 6 to 10 October 2008. Under the guidance, as given in Section 3.1(1 to 4) above, the TCP is collaborating closely with the DRR programme to encourage the involvement of DRR communities in these sessions.

3.5 The Committee was pleased to note that various training activities were organized through the TCP to further enhance and build capacity of National Meteorological and Hydrological Services (NMHSs) in tropical cyclone and related areas. These include the

annual RA IV Workshops on Hurricane Forecasting and Warning (Miami, USA, 16-28 April 2007 & 7-19 April 2008); the biennial Southern Hemisphere Training Course on Tropical Cyclones and Workshop on Public Weather Services (Melbourne, Australia, 10-21 October 2007); and the biennial RA I Training Course on Tropical Cyclones and Public Weather Services (St Denis, La Réunion, 23 October - 4 November 2006). Similar training programmes such as 2008 roving seminars are planned jointly with PWS to be held in the Tropical Cyclone Committee regions. Training attachments were also carried out by four RSMCs in the past two years, with RSMC Nadi, hosting one of them.

3.6 The Committee was informed that the Regional Association V (South-West Pacific) Tropical Cyclone Committee for the South Pacific and South-East Indian Ocean (RA V/TCC) was represented by researchers and forecasters from Australia, Cook Islands, Fiji, Kiribati, New Zealand, Samoa, Solomon Islands and United Kingdom at the Sixth International Workshop on Tropical Cyclones (IWTC-VI), held in San Jose, Costa Rica, 21-30 November 2006.

3.7 The Committee noted that the TCP is actively promoting the use and application of tropical cyclone and related research findings to operational matters, in cooperation with AREP. Examples include the International Training Workshop on Tropical Cyclone Disaster Reduction held in Guangzhou, China in March 2007 and the RA I Regional Workshop on Tropical Cyclone Research held in La Réunion, from 26 to 30 May 2008.

3.8 The Committee noted with satisfaction that the ongoing efforts by the TCP to update the manual "Global Guide to Tropical Cyclone Forecasting" in respond to the recommendation of IWTC-VI. The new version is expected to be finalized at the end of 2009 or early 2010. A new structure for the Guide is currently under review based on the recognition that;

- 1) It should be web based in view of cost saving and easier access; and
- 2) It should have linkages with tropical cyclone related hazards (storm-surge, flash flood, etc.) based on a multi-hazard approach.

3.9 The Committee was informed that Regional Workshops on Storm Surge and Wave Forecasting (SSWF) training programme was reviewed by the TCP. The main objective of the workshop is to train forecasters on operational wave and storm surge forecasting modeling and application. The SSWF programme originated from the first Storm Surge Workshop for the South China Sea, held in 2002 in Viet Nam, a joint effort by the TCP and the Typhoon Committee. Since then, four workshops have been completed for members of RA II and RA V. Storm-surge operations have also been trialed out at several NMHSs. The TCP, in cooperation with the MMOP, are planning to expand the programme to members of RA IV and RA I. The fifth workshop is scheduled to be held in Melbourne, Australia, in December 2008.

3.10 The Committee was informed that completion of the Study on the Wind Averaging Guideline has been delayed. The main report, prepared by the Systems Engineering Australia Pty Ltd (SEA) in January 2008, was reviewed by the Working Group of the TCP Technical Coordination Meeting, and a one-page summary for inclusion in operational manuals is currently being produced by SEA. The Committee noted the importance of this issue to its work and recommended the establishment of Wind Averaging Guidelines for the RA V/TCC where different averaging standards are currently being used. The Committee requested the Secretary-General to finalize the SEA study as early as possible. It also urged the Secretary General to make the study results available for consideration by Members at its next session before the information could be integrated into the Tropical Cyclone Operational Plan for the South Pacific and South-East Indian Oceans (TCOP).

3.11 The Committee was informed of the delay in development of the tropical cyclone forecasters' website. It noted however that the development of the website is expected to resume soon. In this regard, the Committee urged its Members to provide relevant data and information for the website. The objectives of the website are:

- 1) To serve as a source for tropical cyclone forecasters to obtain forecasting and analytical tools for tropical cyclone development, motion, intensification, and wind distribution;
- 2) To provide a comprehensive set of guides and materials on tropical cyclone forecasts, and some supporting materials like Frequently Asked Questions (FAQs) for different basins; and
- 3) To serve as part of Global Guide to Tropical Cyclone Forecasting.

4. REVIEW OF THE 2006/2007 AND 2007/2008 CYCLONE SEASONS (Agenda item 4)

4.1 The representative of the Regional Specialized Meteorological Centre in Nadi (Fiji) – Specializing in Tropical Cyclones (RSMC Nadi) presented a comprehensive report on the 2006/2007 and the 2007/2008 tropical cyclone seasons, reproduced as **Appendix III to this report**.

4.2 The representative of Australia gave a presentation on the tropical cyclones affecting Australia's area of responsibility (105 Longitude East to 160 Longitude East) during the 2006/2007 and 2007/2008 cyclone seasons. He reported that tropical cyclone seasons had below average tropical cyclone numbers since 2000, with the exception of the two near-average seasons during 2004/2005 and 2005/2006. There were five tropical cyclones, which is less than half the average in the 2006/2007 season. Three of these tropical cyclones were severe (reached Category 3 or more on the Australian scale). In the 2007/2008 season there were ten tropical cyclones of which four were severe, but there were no severe tropical cyclone coastal crossings on the Australian mainland. However tropical cyclones hovering off the northwest coast of Australia caused disruptions to offshore drilling programmes resulting in production losses of AU\$250 million. While tropical cyclone numbers were low there were a large number of tropical depressions that produced severe flooding in eastern Australia. The representative of Australia pointed out that the serious failure of global models to predict the recurvature of tropical cyclone "George" in March 2007 resulting in little notice being provided to the communities. Also included in the report were information on public outreach activities, the Australian tropical cyclone database, training initiatives, storm surge modeling and forecasting issues. The report also included a discussion on the new tropical forecast graphic, which now extends to 48 hours and online tropical cyclone training modules covering Tropical Cyclone Warning Center (TCWC) simulation, Dvorak analysis and storm surge/waves. These modules can be made available to members of the Regional Association V (Southwest Pacific) Tropical Cyclone Committee for the South Pacific and South East Indian Ocean (RA V/TCC).

4.3 Although the Cook Islands has an average of two tropical cyclones a year, the two seasons of 2006/2007 and 2007/2008 did not bring any cyclones to the Islands. There were, however, some concerns in the number of tropical depressions that could have developed into tropical cyclones. Two such tropical depressions in 2007/2008 season caused two boats to be thrown onto the reef within the vicinity of the main harbour in Rarotonga. A review of the criteria determining the transition from tropical depressions to cyclones by RSMC Nadi and some definitions in the Tropical Cyclone Operational Plan for the South Pacific and South-East Indian Ocean (TCOP) would greatly increase the awareness of communities to severe warnings in the Region.

4.4 The representative of Indonesia informed the Committee on the reactivation of the Jakarta Tropical Cyclone Warning Centre (Jakarta TCWC), including a brief history, infrastructure, and activities and staffing of Jakarta TCWC. He informed the Committee that during the 2007/2008 tropical cyclone season only one tropical cyclone "Durga" developed in Jakarta TCWC area of responsibility, producing 3 to 5 metre waves in the west of Sumatra and along the south of Java. He also informed the Committee that the Indonesia Bureau of Meteorology and Geophysics (BMG) has just completed a new building, new home for Jakarta TCWC. Jakarta TCWC websites are <http://maritim.bmg.go.id/cyclones/> and <http://www.bmg.go.id>.

4.5 The representative of the Federated States of Micronesia informed the Committee that the 2006/2007 cyclone season was relatively quiet with no tropical cyclones in the central Pacific. Nevertheless, events unrelated to tropical cyclones such as high tides, salt intrusion and inundation had a tremendous impact on most of the low islands in Micronesia with significant damage to food crops. He informed the Committee that the United States Government had kindly upgraded the facilities with a new Weather Service Office (WSO) in Majuro (Marshall Islands) which was completed in 2008; the construction of a WSO Office in Koror (Palau) is underway; and the approval for a new building for WSO in Pohnpei (Federated States of Micronesia)

4.6 The representative of French Polynesia informed the Committee that there were two tropical cyclones, "*Zita*" and "*Arthur*" in its area of responsibility during the 2006/2007 cyclone season. While little damage was reported there were two other exceptionally heavy rainfall events that produced serious damage to some Islands. He also reported that no important phenomena occurred during the 2007/2008 tropical cyclone season due to the influence of La Niña which caused tropical disturbances to be developed further west.

4.7 The representative of Fiji informed the Committee that one cyclone affected Fiji during the 2006/2007 tropical cyclone season and three cyclones affected the country during the 2007/2008 season. Extensive damage was induced by landslides and flooding with all of these cyclones. Tropical cyclone "*Gene*" had the most significant impact on the country with the loss of six lives. The report concluded with recommendations on the need for adequate observations and the need to calibrate the Dvorak analysis technique for the Pacific region.

4.8 The representative of Kiribati informed the Committee that there had been no tropical cyclone activity in that area during the 2006/2007 and 2007/2008 seasons. He acknowledged the important role played by RSMC Nadi in providing weather forecasts to Small Island Developing States (SIDS) and Least Developed Countries (LDCs) such as Kiribati, in the Pacific region.

4.9 The representative of New Caledonia informed the Committee that during the 2006/2007 cyclone season three tropical cyclones came close to New Caledonia area of responsibility, but only tropical cyclone "*Becky*" threatened the territory. The 2006/2007 tropical cyclone season set a new record for the earliest start to any cyclone season. The 2007/2008 tropical cyclone season was very quiet and only one cyclone, "*Gene*", came close to, and produced very heavy rainfall across New Caledonia. The report also included a summary of the intra-seasonal forecasting technique jointly developed with Australia based on phases of the Madden Julian Oscillation (MJO) and is available at <http://www.meteo.nc/espro/previcycl/cyclA.php>

4.10 The representative of New Zealand informed the Committee that during the 2006/2007 cyclone season only three tropical cyclones crossed 25° South into the Wellington area of responsibility out of the nine cyclones that were formed over the Coral Sea and the South Pacific area. All three tropical cyclones "*Cliff*", "*Zita*" and "*Arthur*" remained over water and did not threaten any land areas over the southern ocean. Tropical cyclone "*Arthur*" was the strongest of the three cyclones continuing as a tropical cyclone until it reached 31 Degree Latitude South and 145 Degree Longitude West. During the 2007/2008 cyclone season, only two tropical cyclones crossed 25 Degree Latitude South into the Wellington area of responsibility out of the four that formed over the Coral Sea and the South Pacific area. Tropical cyclone "*Funa*" moved southwards, west of the North Island of New Zealand, before dissipating. Tropical cyclone "*Gene*" remained over open waters east of New Zealand after crossing 25 Degree Latitude South and went through a classic extra-tropical transition over colder waters.

4.11 The representative of Niue informed the Committee that during the 2006/2007 cyclone season, only two tropical cyclones, namely "*Cliff*" and "*Authur*", passed about 800 kilometers from the island to the north and south, respectively. These tropical cyclones did not cause any damages to Niue. During the 2007/2008 season, one tropical cyclone, "*Elisa*", passed between 600 to 700 kilometers to the west of Niue. The only impact from tropical cyclone

“Elisa” was its remnants bringing heavy rainfall to Niue. The Niue Disaster Council (NDC), Government, media and public were kept well informed of any information regarding tropical cyclone warnings during the 2006/2007 and 2007/2008 tropical cyclone seasons.

4.12 The representative of Papua New Guinea informed the Committee that Papua New Guinea on average has about one tropical cyclone per season and the region experienced one cyclone over each of the past 2006/2007 and 2007/2008 seasons. Neither tropical cyclone *“Pierre”* in the 2006/2007 season nor tropical *“Guba”* in the 2007/2008 season was severe cyclones. However, tropical cyclone *“Guba”* caused severe flooding over Oro Province during its slow development phase. More than 200 people were killed as a result of the flooding and landslides with significant loss of infrastructure and food crops.

4.13 The representative of Samoa informed the Committee that two tropical cyclones affected the country during the 2006/2007 tropical cyclone season. However, no tropical cyclones were experienced during the 2007/2008 tropical cyclone season. He expressed sincere appreciation to RSMC Nadi for the Special Advisories for Samoa during the 2006/2007 tropical cyclone season to assist with the preparation of local weather forecasts, which were then translated into local language for dissemination to the public. The representative also informed the Committee that a new building for the Meteorological Service Division was completed in late 2007.

4.14 The Weather Service Office at Pago Pago conducted widespread public awareness and preparedness programs and outreach throughout the years with increased activities in October on the onset of the Hurricane Season. The 2006-2007 Hurricane seasons saw lots of rain in the first three months as the semi permanent monsoonal trough north and north of the islands moved closer to the islands spreading heavy rain and gusty winds across the group. Rainfall amounts of 58.73 inches were recorded in November, December and January, which was 20.17 inches above normal. Winds gusting to 30 knots or higher were recorded in all three months. The rest of the season was very quite with less than normal rainfall with no significant wind events. The first two months of the 2007-2008 seasons were very quite. December 2007 to February 2008 saw the monsoonal trough extends from the Solomon Islands to Fiji southeastward, which at times migrated northward and closer to the Samoa group. This produced wetter conditions in January with 8.15 inches of rainfall above normal rainfall of 14.02 inches. No significant winds were reported above 30 knots.

4.15 The representative of Solomon Islands reported that the 2006/2007 and 2007/2008 cyclone seasons ended with no major cyclones that significantly affected the Solomon Islands. A number of tropical depressions were analyzed near Rennell and Bellona Provinces but they either dissipated or moved away from the area before they developed into tropical cyclones. However, tropical cyclones that posed some threat were *“Yani”*, *“Becky”* and *“Pierre”*. The impacts from these cyclones were mainly restricted to flooding in low-lying areas affecting food crops and minor damages to buildings. He advised the committee that a construction of a new building would soon be commenced for the Weather Service and two new observing stations would soon be opened in the southern islands.

4.16 The representative of Tonga informed the Committee that there were a total of three tropical cyclones affecting Tonga during the 2006/2007 and 2007/2008 tropical cyclone seasons, but no serious damages were reported. During tropical cyclone *“Cliff”* the Meteorological Service operation were forced to relocate due to power failure. The report concluded by expressing concerns about the media obtaining copies of the Special Weather Bulletins (SWB) from the RSMC Nadi via Fiji Meteorological Service website before they were received by Tonga Meteorological Service.

4.17 The representative of Vanuatu informed the Committee that there were only two tropical cyclones, *“Xavier”* and *“Becky”* during the 2006/2007 season, and it was a relatively quiet season in comparison with previous seasons. It is worth noting that tropical cyclone *“Xavier”* came a month earlier than the official start of the cyclone season. In the 2007/2008 season tropical cyclone *“Gene”* caused significant damage to Futuna although the cyclone passed to its east, while tropical cyclone *“Funa”* caused some damages in the northern islands of Vanuatu. The report concluded by informing the Committee that a new building for

the Vanuatu Meteorological Service is scheduled for completion in early 2009.

4.18 The representative of the United States of America (USA) informed the Committee that the 2006/2007 central north Pacific tropical cyclone season had near normal activity. A total of five tropical cyclones occurred during the season, including two hurricanes. One of the hurricanes, "*Ioke*", reached Category 5 intensity, set a new record for the lowest estimated surface pressure for any hurricane within the central north Pacific, and was a Category 4 or higher hurricane for 198 consecutive hours, the longest continuous time period at that intensity observed for any tropical cyclone anywhere on earth. Remnants of both hurricane "*Daniel*" and TD-04C caused heavy rains across the Big Island of Hawaii. The 2007 central north Pacific tropical cyclone season had below normal activity with the occurrence of a La Nina. A total of only two tropical cyclones occurred during the season, including only one hurricane. Tropical depression "*Cosme*" produced rainfall totals of 6.94 inches at Hakalau, 6.68 inches at Glenwood, 4.77 inches at Waiakea Uka, and 4.37 inches at Mountain View as it passed. Hurricane "*Flossie*" passed about 100 miles south of the big Island of Hawaii, but generated waves estimated to be near 20 feet on the island. Coincident with the passage of "*Flossie*", a 44 acre of lava bench slipped into the ocean and it is possible this loss of shoreline was due to the large pounding surf generated by the hurricane. The long-term averages for the central north Pacific season are 4.4 total tropical cyclones, 1.6 being hurricanes, 1.3 tropical storms and 1.5 tropical depressions.

4.19 The reports and/or power-point presentations on the 2006/2007 and 2007/2008 cyclone seasons provided by members of RA V/TCC are given in **Appendix IV**.

5. REVIEW OF THE TROPICAL CYCLONE OPERATIONAL PLAN FOR THE SOUTH PACIFIC AND SOUTH-EAST INDIAN OCEAN (Agenda item 5)

5.1 The Committee recalled from its tenth session (Brisbane, Australia July 2004) and its eleventh session (Adelaide, Australia, May 2006) the establishment of a sub-group to review and update the Tropical Cyclone Operational Plan for the South Pacific and South-East Ocean (TCOP) during the intersessions, taking into consideration action items identified in Sections 5 of the final report of the eleventh session of the Committee, as reproduced in Section 5.2 (a) to (m) below. Due to other work commitments, the sub-group was unable to carry out its work.

5.2 The Committee, at its twelfth session (Alofi, Niue July 2008) reaffirmed its effort to complete the tasks agreed to during its tenth and eleventh sessions, reproduced below;

- a) The inclusion of the type, format and content of graphical products being produced in the Region V and the URLs for the location of examples.
- b) Definitions of categories of tropical cyclones or hurricane intensity including both the Australian and United States categories and their associated wind speed.
- c) The method of retiring names and should the Committee keep the current method or adopt some new method.
- d) The inclusion of the Emergency Managers Weather Information Network (EMWIN) headers in the TCOP in Attachment 3C. There were some discussion whether there should be either a third column to Attachment 3C or a separate table.
- e) Backup issues such as those regarding Wellington Tropical Cyclone Warning Centre (Wellington TCWC), Vanuatu, Samoa, American Samoa, and others; and to explore the use of the Tropical Cyclone Module to assist in any backup situation and list these in Chapter 6, Contingency Plans.
- f) Chapter 7 – Pro-Forma for Cyclone Damage Assessment Report. This has been discussed for four years and needs to be resolved by the twelfth session

of RA V/TCC.

- g) Documentation on the transmission of warning information on WWVH.
- h) The Committee discussed several of the terms provided in Chapter 1 and agreed upon changes to “maximum wind speed in a tropical cyclone”; the corresponding French equivalent; “centre of the tropical cyclone”; “storm tide”; to further study the definition of “tropical disturbance” and “tropical disturbance advisory/bulletin/summary”; and to define “wave setup”.
- i) In Chapter 2, responsibilities of members, the Committee agreed to move the warning areas responsibilities and the role of the Regional Specialized Meteorological Centres (RSMCs)/Tropical Cyclone Warning Centres (TCWCs) to Chapter 1; and to annotate that Indonesia will take over tropical cyclone responsibilities for their area at the start of the 2007/2008 season.
- j) In Chapter 3, the Committee agreed that the format and content of the products listed for each RSMC/TCWC should, as much as possible, be the same.
- k) The Committee discussed many possible ways for members to help each other to disseminate their warnings and other tropical cyclone products. These included possible additional broadcast on Radio Samoa, Radio Vanuatu, Radio Tonga, and others. However, it was agreed that these changes could not be made at this session because of the required approvals and coordination needed with their respective national authorities prior to implementation. Therefore, this will be a discussion item at the twelve session of RA V/TCC. Once these are determined and approved, the URL for the various radio stations involved should be listed in Attachment 4A.
- l) Each member of the RA V/TCC to review Attachment 5B and to provide updates as needed.
- m) The Committee requested the WMO Secretariat to publish a new edition of the TCOP in English and French versions as a WMO Technical Document (WMO/TD-No. 292) in the TCP series (TCP Report No. TCP-24), before the start of the 2006/2007 tropical cyclone season.

5.3 The Committee further examined in detail and discussed further changes to the TCOP during its twelfth session. It agreed that in addition to those changes identified during its tenth and eleventh sessions, as presented in Section 5.2 above, to amend the text and attachments of the TCOP in the following Chapters.

- 1) Chapter 1
 - a) Amend the double (**) at bottom of page I-4 to read “*Used by Australia, Papua New Guinea, American Samoa, Samoa and Vanuatu*”.
- 2) Chapter 2
 - a) Section 2.1.1: remove *footnote (*) and all the other footnotes referring to the definition of "Member"* except the first one in Chapter 1, Section 1.1.
 - b) Section 2.1.1: *remove footnote (***)*. The footnote is identical to the text to which it is a footnote.
 - c) Section 2.1.1: add a footnote to Norfolk Island in “*New Zealand The coastal waters and land areas of New Zealand and Norfolk Island*” to

read, "For clarification, all forecasts and warnings for Norfolk Island resulting from systems [bold] other than tropical cyclones are to be issued by the Australian Bureau of Meteorology Sydney Regional Forecast Center (RFC)".

- d) Section 2.1.1.1: amend the second paragraph to read "Brisbane Tropical Cyclone Warning Centre (TCWC) is responsible for providing special advisory messages for use by National Meteorological Centre in Solomon Islands in the preparation of warnings and advisories".
- e) Section 2.1.2: replace "Indonesia" with "Jakarta TCWC" and delete cross (+) reference.
- f) Section 2.2.1: replace "Wellington RSMC" with "Wellington TCWC".
- g) Section 2.2.1.1 and paragraph 3: replace "Wellington" with "Wellington TCWC".
- h) Section 3 and Table 1: retire "Guba" from List A and add "Maila" to bottom of List A and add "Auram" to List B.
- i) Table 1, add new Section 4 "Jakarta TCWC Area of Responsibility" and add its list of tropical cyclone names.

NB: Jakarta TCWC - The name of a new tropical cyclone is determined by sequential cycling through List A. Standby List B is used to replace retired names in List A and any replacement will be added to the bottom of List A to maintain the alphabetical order.

LIST A	LIST B
1. Anggrek	1. Anggur
2. Bakung	2. Belimbing
3. Cempaka	3. Duku
4. Dahlia	4. Jambu
5. Flamboyan	5. Lengking
6. Kenanga	6. Mangga
7. Lili	7. Nangka
8. Mawar	8. Pisang
9. Seroja	9. Rambuta
10. Teratai	10. Sawo

- 3) Chapter 3
 - a) Section 3.2.1.1 (g): delete "Futuna" and add it to "Wallis" to read "Wallis and Futuna". Replace "Wellington RSMC" with "Wellington TCWC".
 - b) Section 3.2.1.2: add an asterix (*) to "Tropical cyclone alert" and have it at the bottom of page III-3 to read "**Tropical cyclone watch in Samoa".
 - c) Section 3.2.4.3: delete (a), (b) and (c).
 - d) Add new Section between 3.2.6 and 3.2.7 and call it 3.2.7 to read
 - 3.2.7 *Jakarta TCWC*
 - 3.2.7.1 *High seas warnings*
 These are issued in accordance with standard international procedures and WMO format for marine warnings (see Attachment 3A).

(a) Criterion for first issue

The first of a series is issued as soon as gale force or storm force winds are expected in the area of responsibility with 24 hours

(b) Time and frequency of subsequent issues are six hourly (at 0130, 0730, 1330 and 1930 UTC) unless a major amendment is necessary at an intermediate time

- e) Current Section 3.2.7 New Caledonia Meteorological Service, Noumea becomes Section 3.2.8.
- f) Current Section 3.3.8 French Polynesia Meteorological Service, Tahiti becomes Section 3.2.9.
- g) Attachment 3A: amend 3.A.2 to correspond to 3.A.1.
- h) Section 3.A.2, and second last paragraph: amend to read *“Port Moresby TCWC does not provide a 24-hour forecast but provide a central pressure forecast for 12 hour hence”*.
- i) Attachment 3C: under RSMC/WFO Honolulu, delete WMO abbreviated headings: FXPS60 PHFO, ACPA40 PHFO and ACPW40 PHFO, and their related type of bulletins.
- j) Attachment 3C: add new centre *“Jakarta TCWC”* and its WMO abbreviated headings and type of bulletins

WMO Abbreviated Headings

WTID01 WIIX
 WTID02 WIIX
 WCID01 WIIX
 WCID02 WIIX

Type of Bulletins

High Seas Warnings
 High Seas Warnings
 SIGMET
 SIGMET

4) Chapter 4

- a) Section 4.2.1 and paragraph 4: replace *“Wellington”* with *“Wellington TCWC”*.
- b) Section 4.2.2: amend to read *“Radio Samoa broadcasts Special Weather Bulletins for Tokelau in local languages”*.
- c) Add a new Section 4.2.3 to include radio broadcasts for individual country, if necessary.
- d) Attachment 4A: consider adding a text on radio fax from Australia Bureau of Meteorology and radio voice broadcasts from US NOAA NWS Honolulu RSMC/WFO.

5) Chapter 5

- a) Section 5.3: replace *“Wellington RSMC”* with *“Wellington TCWC”*.

6) Chapter 6

- a) Section 6.3.1: replace *“Wellington”* with *“Wellington TCWC”*.
- b) Section 6.3.7: amend to read *“Failure or partial failure of Samoa*

Weather Forecasting Office.....” .

- c) Add new Section 6.3.8 *“Failure or partial failure of Vanuatu Meteorological Service Forecasting Centre, RSMC Nadi assumes full responsibility”.*
- d) Add new Section 6.3.8 *“Failure of Jakarta TCWC, Perth TCWC assumes full responsibility. However, in special circumstances Darwin TCWC may do so”.*
- e) Attachment 6A: amend to read

Wellington TCWC will assume temporary responsibility of TCWC functions in RSMC Nadi’s area of responsibility, as outlined in Chapter 2 of this manual, whenever RSMC Nadi is temporary unable to carry out this role through

- i) communication failure, or*
- ii) storm damage, or*
- iii) planned shutdown of facilities for routine maintenance.*

For the purpose of this arrangement, these functions are:

Special Advisories for Vanuatu and Samoa

Tropical Disturbance Summaries

SIGMETs for the Nadi FIR

Aviation advisory information as required by an ICAO designated Tropical Cyclone Advisory Centre as documented in Annex 3 to the Convention on International Civil Aviation.

In addition to the TCWC responsibilities of RSMC Nadi, Wellington TCWC will also provide temporary backup, with conditions stated above, for marine forecasts and warnings for the high seas of MetArea XIV and MetArea X for which RSMC Nadi has agreed to act as a “Preparation Service” and as documented in the WMO Manual of Marine Meteorological Services (No. 558).

7) General

- a) To include Pitcairn Island in the TCOP.
- b) To consider Tonga’s concern that the *“Special Weather Bulletin is too long and difficult to translate into the local language”.*
- c) To consider Vanuatu request for RSMC Nadi not to put *“Special Advisories for Vanuatu”* on Fiji Meteorological Service website.
- d) To define *“heavy swell”.*
- e) To look into the definition of *“coastal waters”* taking into full consideration its origin and various definitions that may already exist.
- f) To define the different tropical cyclone category systems used in Region V.
- g) Australia to provide update information for Attachment 3C.
- h) Remove *“Banaba”* where it appears in the TCOP.

- i) Fiji proposed to retire the names “Cliff”, “Daman” and “Gene” from Table 1 and to replace them with “Chip”, “Denia” and “Glen” from the Standby List and to add “Cook”, “Dean” and “Garth” to the Standby List.
- j) Vanuatu proposed to retire “Funa” from Table 1 and to replace it with “Fotu” from the standby list and to add “Florin” to the Standby List.
- k) Samoa proposed to add the following names to the standby list in Table 1: “Saga”, “Lea”, “Kamu”, “Pena” and “Elia”.
- l) Through out the TCOP, the phrase “RSMC Wellington” should be replaced with “Wellington TCWC”, if it has not been indicated in the above required changes.
- m) To define “Members” and “members” in the TCOP.
- n) To recommend to the WMO Secretariat to provide an update briefing on the status and responsibilities of WMO designated RSMC and TCWC throughout the globe to the thirteenth session of RA V/TCC.
- o) It is important to record a footnote for “members” in the first instance. Hence, remove all other additional footnotes to “member”.

6 REVIEW OF THE COMMITTEE TECHNICAL PLAN AND IMPLEMENTATION PROGRAMME FOR THE PERIOD 2008 – 2012 (Agenda item 6)

6.0.1 Under this agenda item, the Committee established a subgroup under the leadership of Mr Alan Sharp (Australia) to assist the Committee to review the current Technical Plan and to update to update it for the period 2008-2012.

6.0.2 With the help of the subgroup, the Committee considered the Technical Plan and Implementation Programme and made a number of amendments. The updated Technical Plan is given in **Appendix V**.

6.1 Meteorological Component (Agenda item 6.1)

6.1.2 The Committee noted the information presented in document RA V/TCC-XII/Doc. 8 – Meteorology Component. The Committee also recommended to the WMO Secretariat to explore ways to improve reporting of SYNOP and TEMP messages at the MTN centers, to better reflect NMHSs efforts at the national level and between the Regional Telecommunication Hub in Wellington (RTH-Wellington) and MTN centers.

6.1.3 The Committee further noted that most of the information under the meteorology component is related to the works of the Regional Association V (South-West Pacific) Working Group on Planning and Implementation of the World Weather Watch (WWW) Programme (RA V WG/PIW) in Regional Association V (South-West Pacific). In this connection, the Committee recommended to the WMO Secretariat to ensure that the Chairperson of the RA V WG/PIW to participate in all future sessions of the RA V/TCC to enable the Committee to have discussions as well as to convey through the Chairperson to RA V WG/PIW the meteorology component requirements to benefit the works of both Committees.

6.1.4 The Committee, noting the importance of observational data for detection, analysis and monitoring of tropical cyclones and related disturbances, urged its members to ensure the timely collection and provision of these data in accordance with WMO standards to relevant national and regional telecommunication hubs.

6.1.5 The Committee recognized the urgent need to restore, upgrade, maintain, enhance and sustain existing observational and telecommunication networks within the Pacific region,

in particular, the Regional Basic Synoptic Network (RBSN) and HF/RANET system. In this regard, the Committee urged WMO Members to sustain and seek new and additional financial support from their respective governments and development partners to ensure emergency, preventative and routine maintenance support, enhancement and sustainability of the existing observational and telecommunication networks.

6.1.6 The Committee noted with deep appreciation the ongoing regional maintenance and technical support services currently provided by the Meteorological Service of New Zealand Ltd (MetService) with financial support from US NOAA GCOS Technical Support Project (TSP), Met Office UK Pacific Fund (PF), New Zealand Ministry of Transport (NPAC) and NZAID to twelve Pacific Islands and Territories (PICTs) namely, Cook Islands; Kiribati; Fiji; Niue; Papua New Guinea; Pitcairn Island; Samoa; Solomon Islands; Tonga; Tuvalu; Tokelau and Vanuatu. It urged WMO Members, relevant regional and international development partners to provide additional financial and other support such as spare parts and consumables to the MetService programme to ensure its continuity and long-term sustainability.

6.2 Hydrological Component (Agenda item 6.2)

6.2.1 The Committee noted the information presented in document RA V/TCC-XII/Doc. 9 – Hydrological Component. The Committee recommended to the WMO Secretariat to explore ways to improve the reporting in order for it to be beneficial to the works of RA V/TCC members, taking into full consideration the latest up-to-date information on the implementation of hydrology and water resources activities in Region V. This includes the Pacific-HYCOS activities in each participating country and strategic linkages or/and synergy between the works of WMO Hydrology and Water Resources (HWR)) and the Tropical Cyclone Programme (TCP).

6.3 Disaster Risk Reduction Component (Agenda item 6.3)

6.3.1 The Committee noted the information presented in document RA V/TCC-XII/Doc. 10 – Disaster Prevention and Preparedness Component. The Committee agreed with the re-iteration of the importance in getting the tropical cyclone warnings messages to the ‘last mile’ in Region V Members’ communities, and the importance of robust operational and observational infrastructure, inter and intra island communication networks. The Committee also noted that this item has been further discussed during the Disaster Risk Reduction – Side Event and the conclusions and recommendations are presented in Section 8.3.

6.4 Storm Surge Watch Scheme (Agenda item 6.4)

6.4.1 The Committee noted the summary of discussions at the recent Sixtieth Session of the Executive Council (EC-LX) in June 2008, and in particular the request for the Secretary General to facilitate the development of a Storm Surge Watch Scheme to mitigate the impacts of storm surges.

6.4.2 The Committee recognized that in the RAV/TCC area of responsibility that dangerous coastal flooding is often caused by significant waves as well as storm surge and that RSMC Nadi provides qualitative information about these phenomena in their Special Weather Bulletins (SWB). However the Committee recognized that the warning service for these phenomena could be improved.

6.4.3 The Committee decided to form an Action Team to examine the current provision of storm surge and significant wave warning services in Region V, the suitability of those services, and to provide recommendations for improvement in the short and long term, including the desirability and implementing a Storm Surge Watch Scheme in Region V.

6.4.3 The Committee agreed that the Action Team would comprise of:

- a) The Chairman of the RA V/TCC;

- b) A representative of the RSMC Nadi;
- c) Representatives of suitable technical agencies such as New Zealand National Institute of Water and Atmospheric Research Ltd. (NIWA), SOPAC or the Australian Bureau of Meteorology;
- d) A representative of National Meteorological and Hydrological Services (NMHS) in the Region; and
- e) A disaster management expert from a country in the Region.

6.4.3 The Action Team is to meet as soon as practicable and report to the president of RA V.

6.5 Training Component (Agenda item 6.5)

6.5.1 The Committee noted the information presented in document RA V/TCC-XII/Doc. 12 – Training, which comprised mainly of training events organized directly by the WMO Secretariat, in collaboration with its Members since its eleventh session (Adelaide, Australia, May 2006), especially those events that were of direct relevance to tropical cyclones.

- 1) Training Course on Meteorology for Forecasters from South Pacific Islands National Meteorological Services (NMS), Nouméa, New Caledonia, from 4 to 8 September 2006. Sixteen participants from twelve PICTs participated in the training event. The aim of the training course was to increase the awareness of predictability and probabilistic approach, especially for extreme weather forecasting and involve regional forecasters in WMO THORPEX. The government of France funded the training course.
- 2) The fourth Regional Workshop on Storm Surge and Wave Forecasting, Manila, Philippines, from 11 to 15 September 2006. Twenty-nine participants from twelve countries participate in the training event, with the aim of hands-on training on tsunami, storm surge and ocean wave modelling and forecasting.
- 3) Regional Training Course on the Use of Environmental Satellite Data in Meteorological Applications for RA V, Melbourne, Australia, from 16 to 27 October 2006. Thirty-five participants from thirteen countries participated in the training course, on the application of data from environmental satellites both present and future systems; and to train the trainers on the use of satellite data and products in the identification of tropical cyclone development and movement.
- 4) The seventh Southern Hemisphere Training Course on Tropical Cyclones, Melbourne, Australia, from 10 to 14 September 2007 and the seventh Southern Hemisphere Workshop on Public Weather Services, Melbourne, Australia, from 17 to 21 September 2007. Thirteenth participants from ten countries participated in these two events, building their capacity in modern techniques of tropical cyclone forecasting and warning, and skills for delivering those products through the national Public Weather Service programmes and activities.
- 5) The Training Course in Marine Meteorology for the Pacific Small Island Developing States (SIDS) National Meteorological Services (NMS), Tahiti, French Polynesia, from 8 to 12 October 2007. The government of France funded the training course.
- 6) The 2006, 2007 and 2008 Pacific International Desk Training Programme, Honolulu, Hawaii Islands, USA. Since its inception in 2001, 41 people from 15 Members of WMO Regional Association V have attended this programme. Five directors of south Pacific island's meteorological services have

attended the Pacific Desk training (Samoa, Niue, Tonga, Tuvalu, and Kiribati). Three of these attended prior to becoming director. The USA government, through NOAA NWS funded the training programme.

- 7) Training on Operational Tropical Cyclone Forecasting at RSMC, Nadi, Fiji, from 3 to 13 December 2007. Two participants from two countries participated in the on- the-job training programme on tropical cyclone forecasting methods and techniques, as well as familiarization with RSMC Nadi operations.

6.5.2 In addition to these, the Committee acknowledged training events organized by Members, regional organizations and institutions, which had significant contribution to the works of the RA V/TCC. Some of these training activities are given in **Attachment II of Appendix V**.

6.5.3 The Committee expressed its appreciation to WMO Members who offered their national training facilities to other Members under bilateral and multilateral arrangements. These co-operative efforts have been found by the recipient countries to be very useful and the Committee strongly recommended that such endeavours should continue in the future and be strengthened. The Committee urged its members to make maximum use of such training facilities.

6.5.4 The WMO Regional Training Centre (RTC) in the Philippines and RTCs in neighbouring Regions continued to offer regular and specialized training courses in different fields of specialization and at various levels. The Committee encouraged the WMO Secretariat to work together with the RTC Philippines to offer training courses to meet Members of Region V training requirements, including training courses in tropical cyclones.

6.5.5 The Committee was informed about the following training activities planned during the next intersessional period.

- 1) 2008: The fifth Regional Workshop on Storm Surge and Wave Forecasting; the Pacific International Training Desk Programme continues; RSMC Nadi Attachment Training; and the Training Course in Aviation Meteorology for Pacific SIDS NMS, Noumea, New Caledonia, 20 to 24 October 2008.
- 2) 2009: Southern Hemisphere Training Course; RSMC Nadi Attachment Training and a Severe Weather training course for forecasters in Tahiti.

6.5.6 The Committee was informed that the Fiji Meteorological Service (FMS) would conduct a Foundation Observer Course at Nadi, Fiji from mid-August to October 2008. While the course is essentially to meet Fiji national needs, it would also be available to international participants, subject to funding availability. The Committee was also informed that the FMS would conduct another training course in 2009 for ten Pacific Islands under the Japan International Cooperation Agency (JICA) funding, focusing on effectively communicating weather warnings and information to the general public. Details of the training will be announced later. The Committee also noted that Fiji might require WMO assistance to fund an expert as a resource person for the training.

6.5.7 The Committee was informed of the WMO sixth survey, WMO/TD-No.1380 and ETR-No.19, on "Members Training Requirements, Opportunities and Capabilities in Meteorology and Hydrology" during 2006. It recommended to the WMO Secretariat that the results of the survey to be distributed to Members of Region V. Furthermore, the Committee was informed that only nine Members from Region V responded to the questionnaire. In this connection, the Committee strongly encouraged its members to actively respond to the next survey to be carried out in 2010 in order to better identify the training needs of Region V.

6.6 Research Component (Agenda item 6.6)

6.6.1 The Committee noted the information presented in document RA V/TCC-XII/Doc.

13 – Training, which comprised mainly of research activities organized and funded by the WMO Secretariat, in collaboration with its Members. It was informed by its members that there are other research activities, relevant to tropical cyclones, which are carried out by Members, training and research institutions in Region V. In this connection, the Committee recommend to the WMO Secretariat to find improved ways to provide complete information about research activities on tropical cyclones in Region V.

7. ASSISTANCE REQUIRED FOR THE IMPLEMENTATION OF THE PROGRAMME FOR THE DEVELOPMENT OF SERVICES (Agenda Item 7)

7.1 The Committee noted that several of its members continued to benefit from the WMO Voluntary Cooperation Programme (VCP). During the period from January 2006 to June 2008, eight VCP project requests were submitted by five members of the Committee: three of them concerned the upgrading satellite receiving equipment for Low Rate Information Transmission (LRIT), three of them concerned the Internet connection, one for the restoration of surface observing network, and one for the improvement of meteorological telecommunication for the collection of observational data from surface stations and dissemination of tropical cyclone warnings to communities.

7.2 The Committee was informed that eight WMO Members received support for a total of ten VCP projects for equipment and services during the period 2006-2008, and the support include the upgrading of satellite receiving equipment for Low Rate Information Transmission (LRIT). The Committee expressed its appreciation to WMO Members supporting these projects.

7.3 The Committee also noted that eight projects have not received support as of 30 June 2008. It agreed with the concern raised by its members that these requests have remained unfunded for many years. In this connection, the Committee called on Members to support, and the WMO Secretariats to expedite the mobilization and securing of resources for the implementation of these outstanding requests.

7.4 The Committee noted that during the period 2006-2008, assistance being provided under the WMO Emergency Assistance Scheme and the VCP to the NMHSs in Cook Islands, Niue, Samoa and Tonga for the restoration of basic facilities, including EMWIN systems.

7.5 The Committee also noted with appreciation that under the Technical Cooperation among Developing Countries (TCDC), China organized in 2006 and 2007, study tours for Directors and/or Deputy Directors of NMHSs in conjunction with WMO Symposia on Strengthening Cooperation among NMHSs and WMO. It noted that Cook Islands, Indonesia and Vanuatu participated in the study tour during the period 2006-2007. The Committee requested the Secretary-General that Members who did not participate in previous tours to be considered for future tours

7.6 The Committee was informed that a WMO Coordination and Capacity Building Workshop in Asia-Pacific will be held in Port Vila, Vanuatu in October 2008. The main objectives of the workshop include the building of strategic partnership among government entities; sharing experiences on benefits of meteorological information in socio-economic development; and enhancing management skills of senior and middle management staff of NMHSs in LDCs.

7.7 The Committee was informed that New Zealand (MetService jointly with Vitoria University of Wellington (VUW)) will again be running its Meteorologist Course in 2009. Potential candidates are urged to submit their applications online at www.metservice.com. The deadline for applications is 19th December 2008.

7.8 The Committee noted with appreciation the continuing funding from the US NOAA GCOS program, US Climate Change Research Initiative and with the support of Met Office UK, New Zealand MetService and Australian Bureau of Meteorology. Several Global Climate Observing System (GCOS) Upper Air Network (GUAN) stations of members (Cook Islands, Solomon Islands, Papua New Guinea and Vanuatu) were upgraded under these initiatives in the last two years.

7.9 The Committee was informed of the new WMO Development and Regional Activities (DRA) Department. The DRA Department manages: i) Technical Cooperation Programme; ii) Voluntary Cooperation; iii) Programme for the Least Developed Countries; iv) Regional Programme and; v) Education and Training Programme. The Department structure and entities are: i) Resources Mobilization Office; ii) Office of the LDC Programme and Regional Coordination; iii) Regional Offices (Regional Office for Africa, Regional Office for Asia and South-West Pacific), Regional Office for the Americas and Regional Office for Europe); and iv) Education and Training Office. It also noted the new DRA Department has been organized to enhance the capabilities of Members in developing countries, in particular LDC/SID to fulfil their mandate.

7.10 The Committee noted that the Regional Office for Asia and South-West Pacific and WMO Offices for the South-West Pacific in Apia (Samoa), in collaboration with WMO Members and regional organizations such as SPREP and SOPAC continued to play a role in supporting technical cooperation activities in the Region.

8. OTHER BUSINESS (Agenda item 8)

8.1 Severe Weather Forecasting Demonstration Project (Agenda item 8.1)

8.1.1 The Committee was provided with information through a presentation on the Severe Weather Forecast Demonstration Project (SWFDP) firstly implemented in Africa in 2006, along with a proposal to consider a similar project for Region V (South-West Pacific).

8.1.2 The Committee recommended the development, implementation and evaluation of a SWFDP project in Region V. It agreed that this project should include from its outset severe weather forecasting and warning components and a disaster risk reduction component, and would be referred to as the Severe Weather Forecast and Disaster Risk Reduction Demonstration Project (SWFDDP).

8.1.3 The Committee agreed to involve national disaster reduction and disaster management agencies and "last-mile" users of the information, through genuine consultation during the planning, implementation and evaluation stages of the project. The project should address, among others, the following issues:

- 1) Identification of the relevant users (user groups), in particular the disaster risk reduction related partners, in the project member countries;
- 2) Identify the users' requirements for and use of forecast information, products and warnings, including format;
- 3) Cooperation of the various disaster risk reduction related partners at national and international levels;
- 4) Cross-boundary disaster risks;
- 5) Cooperation between NMHSs and intergovernmental and non-governmental emergency relief agencies; and
- 6) Operational arrangements to provide hydro-met services to post-disaster recovery operations.

8.1.4 The Committee also agreed that the project should:

- 1) Identify weaknesses of the interfaces within the EWS (national to community and community back to national level);
- 2) Examine the suitability of existing infrastructure for observations, forecasting, and dissemination of information;

- 3) Identify key partners/users of the NMHSs to determine their requirements;
- 4) Develop products and services such as warning messages, specialized forecasts, advisory services that fulfill the requirements of NMHSs key partners;
- 5) Build capacity through training for forecasters, service users/NMHSs key partners;
- 6) Review and improve infrastructure and channels for dissemination of information to services users/NMHSs partners;
- 7) Provide services to improve community emergency preparedness and response;
- 8) Develop feedback mechanisms for use during and after severe weather events;
- 9) Provide advice to and seek feedback from, users to improve planning, preparedness; response decision making; and
- 10) Undertake an evaluation focussing on sustainability and possible extension plans.

8.1.5 The Committee noted severe weather and tropical cyclone forecasting component should test the usefulness of current and experimental products, in improving severe weather forecasting services in countries where sophisticated model outputs are not currently used. Products including probabilistic predictions from tropical cyclone Ensemble Prediction System (EPS) products available from Numerical Weather Prediction (NWP) centres. The Committee agreed that the SWFDDP would focus on severe weather associated with tropical cyclones, and also heavy precipitation and strong winds not necessarily associated with tropical cyclones, and marine services aspects should also be considered due to the important effects of tropical cyclones on sea-state and related hazards.

8.1.6 The Committee was informed that the demonstration project would implement a "Cascading Forecasting Process" approach via a three-tier network of global, regional, national meteorological centres. The project is envisaged to involve a small group (3-5) of participating countries in a complete end-to-end cascading process, and probably be drawn from countries with National Meteorological and Hydrological Services (NMHSs) currently provided with tropical cyclone advisory products from RSMC Nadi. It is anticipated that other NHMS in Region V (South-West Pacific) not included in this core group could nevertheless have access to the Numerical Weather Prediction (NWP) guidance products via a password protected web site and portal. The group of Regional Centres involved in the subproject is expected to include RSMCs in Nadi, Darwin and Wellington, while Global Centres at United Kingdom Met Office (UKMO), European Center for Medium Range Weather Forecasting (ECMWF) and National Center for Environmental Prediction (NCEP) have expressed support.

8.1.7 The Committee was further informed that some user-defined trial products could be made available during the 2008/2009 tropical cyclone season, and the end-to-end field phase of the project could commence early in the 2009/2010 season. The field phase would include quarterly progress reviews and a final evaluation at the end of the one-year period.

8.1.8 Taking into consideration guidelines for the preparation of a regional subproject in the Commission for Basic System (CBS) SWFDP Guidebook on Planning Regional Subprojects (January 2006), the Committee agreed to establish a Regional Subproject Management Team (RSMT) for Region V, to plan the project, to select the participating countries and NMHSs/Centres, to coordinate the implementation phase and, to arrange the evaluation of the project. The RSMT would report to the RA V/TCC, which would monitor the project progress and make recommendations for decision by the RA V or its president during the intersessional period, as appropriate.

8.1.9 The Committee noted that the members of the RSMT are proposed to include (pending the eventual consent of the Permanent Representatives concerned)

- 1) Regional centres:
 - (i) RSMC Nadi-TCC.
 - (ii) TCWC/RSMC Wellington.
 - (iii) RSMC Darwin.
- 2) Global centres:
 - (i) UKMO.
 - (ii) ECMWF.
 - (iii) NCEP.
- 3) NMHSs and corresponding national disaster risk reduction representatives. The 3 pilot countries and related NMHSs would be selected for participation in the Region V SWFDDP subproject using criteria established to be provided by the WMO Secretariat, taking into consideration these general criteria:
 - (i) Legal framework and coordination mechanisms for disaster risk reduction exist;
 - (ii) Institutional capacity for operational processes at national to local levels exist;
 - (iii) NMHS has the capacity to support EWS;
 - (iv) NMHS is willing to engage in the project; and
 - (v) The country has reasonable operational emergency response mechanisms in place.
- 4) Disaster risk reduction sector (perhaps SPREP and/or SOPAC - to be advised by the Chairperson of RA V Working Group on DRR).
- 5) Chairperson of the RA V Working Group on DRR.
- 6) RSMC/WFO Honolulu, Meteo-France (New Caledonia and French Polynesia) Japan Meteorological Agency may be involved in the project implementation and may also be members of the RSMT

8.2 Support to Fiji (Agenda item 8.2)

8.2.1 The Committee noted that:

- 1) The Fiji Meteorological Service (FMS) is responsible to maintain its infrastructure. For a department within national government very little resources and lowering budgets pose challenges in maintaining regional operations and services. This was expressed at the 11th Regional Meteorological Services Directors (Noumea, New Caledonia, July 2006) organized under the auspices of the Secretariat of the Pacific Environment Programme (SPREP).
- 2) The 15th World Meteorological Congress (Geneva, May 2007) expressed serious concern on the operational status of the Regional Specialized Meteorological Centre in Nadi (Fiji) – specializing in tropical cyclones (RSMC Nadi-TCC), which is experiencing an acute shortage of professional forecasting

staff that might soon have an impact on the provision of vital services. In this regard, Congress requested the Secretary-General to urgently consider possible support for that issue in cooperation with RA V Members to avoid interruption of tropical cyclone warning services in the Pacific, as well as general services, especially aviation weather services, currently provided by RSMC Nadi, which was also designated International Civil Aviation Organization (ICAO) Tropical Cyclone Advisory Center (TCAC); and

- 3) The 12th Meeting of Regional Meteorological Services Directors (Rarotonga, Cook Islands, July 2007) organized under the auspices of SPREP, among its many recommendations:

-- Requested WMO in collaboration with SOPAC, SPREP and Pacific Islands national governments to organize, as a matter of highest priority, a high level dialogue amongst all parties involved in the provision of backup services to RSMC Nadi and those Pacific Islands receiving services from RSMC Nadi. The goal of the dialogue is to review the current allocation of backup responsibilities for issuance of tropical cyclone warnings in the event RSMC Nadi is unable to fulfill this role.

-- Given that the present back up arrangements do not cover the full range of services required by Pacific Islands that depend on RSMC Nadi, the meeting requested Fiji and all stakeholders to pursue a more robust backup arrangements for services other than those agreed to under Attachment 6A Fiji-New Zealand TCWC contingency arrangements, Annex 3, ICAO TCAC, and those services provided for under the WMO Manual on Marine Meteorological Services, No. 558.

-- In light of the importance of this matter to the region, the meeting requested Pacific Island Countries, SOPAC, SPREP and WMO to raise this matter at the upcoming Pacific Islands Forum Meeting to be held in Nuku'alofa, Tonga, 16-17 October 2007. It further requested that the findings and recommendations of the WMO led mission to Fiji in July 2007 form a part of each organizations' submissions to the Forum meeting.

-- Urged Pacific Islands NMS Directors to bring the RSMC Nadi issue to the attention of their governments.

-- Urged Pacific Islands NMSs to second their meteorologists to Nadi RSMC especially during times of acute staff shortage and preferably during tropical cyclone seasons, to support the forecasting operations at RSMC Nadi where possible.

8.2.2 The Committee further noted that various actions have been taken since the last session in May 2006 to address RSMC Nadi issues:

- 1) The finding and recommendation from the WMO led fact-finding mission to Fiji and its report (July 2007), to strengthen the capability of FMS/RSMC Nadi;
- 2) The Pacific Island Forum Secretariat (PIFS) Sixteenth Smaller Island States (SIS) Leaders' Summit (Nuku'alofa, Tonga, October 2007) urgently called for the immediate review of current arrangements and propose options for strengthening of, as well as a sustainable regional and national institutions and services for monitoring and communicating weather, climate and extreme events in the Pacific region;
- 3) In responding to 8.2.2(2) above, the PIFS has prepared and submitted a policy paper titled '*Options for Strengthening Regional Meteorological Support to National Weather and Climate Services*' to the PIFS Seventeenth SIS Leaders' Summit to be held in Niue, on 25 of August 2008; and

- 4) FMS is in the process of recruiting several graduates to undergo meteorologist training over the next 2 to 3 years. It is also upgrading its integrated meteorological system, including upgrades to its satellite data receiving systems and computing facilities. The project is funded by Fiji Government and is scheduled for completion in 2009. FMS is also likely to undergo reforms to achieve greater sustainability of its services in the future.

8.2.3 The Committee was informed of concerns and recommendations from various fora, such as the Fifteenth World Meteorological Congress (May 2007) and the SPREP Regional Meteorological Services Directors (RMSD) meetings, which led to the WMO led-fact finding mission to Fiji on RSMC Nadi in July 2007. The findings and recommendations of the mission and subsequent decision of the Sixtieth Session of the Executive Council (June 2008) were presented to the Committee. The Committee noted that some of the recommendations could be addressed through a long-term process while some are very urgent and need to be address immediately. While acknowledging and recognizing the policy paper being prepared and to be presented to the upcoming Seventeenth PIFS SIS Leaders' Summit in August 2008, the Committee recognized that the outcomes would likely not have immediate impact on the short term issues related to regional meteorological services, in particular those related to its work such as back up arrangements for Nadi RSMC under the TCOP. It urged members to support this long-term initiative while assisting RSMC Nadi through the continuation of training and capacity building opportunities and where possible the secondment of suitable staff.

8.2.4 The Committee also noted that one of the high priority and urgent requirements identified in the mission's report is the *"long-term contingency backup plan for RSMC Nadi required for daily public and marine forecasts for nine PICTs (Cook Islands, Fiji, Kiribati, Nauru, Niue, Tokelau, Tonga, Tuvalu and Wallis & Futuna) and for aviation forecasts (TAFs and Area Forecasts) for 10 aerodromes in six PICTs (Cook Islands, Kiribati, Nauru, Niue, Samoa and Tonga)"*. Taking into full consideration the recommendations from the 12RSMD (Rarotonga, Cook Islands, July 2008), the Committee requested the Secretary-General to organize such a high level dialogue.

8.3 Special Session on Disaster Risk Reduction

8.3.1 Since many members of the RA V Tropical Cyclone Committee are also members of the RA V Working Group on Disaster Risk Reduction, a special session on disaster risk reduction was arranged back-to-back with the Twelfth session of the Regional Association V (South-West Pacific) Tropical Cyclone Committee for the South Pacific and South-East Indian Ocean (XII-RA V/TCC), in Niue on 12 July 2008. Arona Ngari, president of RA V facilitated the session.

8.3.2 The objectives of the session were

- 1) To discuss regional needs, gaps and requirements and identify capacities of all relevant partners;
- 2) To determine a coordinated regional planning approach for development and implementation of regional / national capacities for early warning systems and risk assessment based upon existing regional mechanisms; and
- 3) To determine potential coordination mechanisms built for hydrological, meteorological and climate related hazards to assist members in RA V in a more coordinated and sustainable fashion.

The agenda included the followings items. The presentation is given in **Appendix VI**.

- 1) Disaster risk reduction developments in RA V – Led by Mr Noud Leenders (SOPAC);

- 2) WMO initiatives under its DRR Programme in the area of risk assessment and multi-hazard early warning systems - Led by Mr Dieter Schiessl (WMO);
- 3) Discussion of Major gaps/needs and challenges for implementation of early warning systems in RA V - Led by Dr Linda Anderson-Berry (Chairperson RA V DRR WG, Mr Arona Ngari (president of RA V), and Mr Leenders; and
- 4) Mechanisms for leveraging regional expertise, activities and resources and mechanisms to implement multi-hazard early warning systems in the RA V - Led by Mr Schiessl.

8.3.3 The session started with a presentation by Mr Schiessl providing an overview in the following areas.

- 1) The WMO DRR programme in terms of its history, profile and current priorities;
- 2) WMO links with international DRR strategies, notably ISDR and the HFA;
- 3) The WMO Strategic Plan 2008-2011 and Beyond, including explanation of its three Top Level Objectives, five Strategic Thrusts and Expected Results; and
- 4) The WMO DRR programme strategic goals. Particular note was made of the current funding priorities and the limited funding available for the RA V Working Group on DRR meetings.

8.3.4 Mr Leenders provided the meeting with an explanation of SOPAC role in the region and detailed some of the current SOPAC supported, collaborative multi-agency DRR activities that are being delivered within the context of the *Pacific Island Countries Framework for Action 2005-2015 Building the Resilience of Nations and Communities to Disasters*.

8.3.5 Dr Anderson-Berry then delivered a presentation that provided the meeting with a report of the WMO DRR program initiated country surveys that explored national DRR capacity.

8.3.6 The final presentation was delivered by Mr Schiessl, providing details of an example pilot project on early warning systems for hydro-meteorological hazards that is currently being developed in Region IV and delivered through the mechanism of a Regional Project Advisory Group (RPAG).

8.3.7 During the “brainstorming” session, the participants were encouraged to contribute ideas. The discussion was framed within the context of DRR end-to-end service delivery priority that conceptualizes warning systems comprised of the following essential components.

- 1) Modelling and forecasting capabilities to develop the message;
- 2) A range of diverse communication channels (networks with media and communication network providers – radio repeaters etc) to transmit the message;
- 3) Infrastructure and networks via which the community receives the message;
- 4) A Message that is understood equally across the target community (this includes such elements as terminology, language, access to public education etc);
- 5) An informed community that will enhance the personalization of the warning message (i.e. that the message is relevant to and has personal meaning for the target individual, community, or stakeholder group);
- 6) A community that is empowered (informed and resourced) to take appropriate

and effective defensive actions (good informed decision making – by policy makers over the longer time frame, emergency managers – medium term and immediate).

8.3.8 The discussions included the following items:

- 1) Given the concerns of the current 'inactive' status of the RA V Working Group on DRR (RA V WG/DRR) inherited from the RA V WG/DPM which was established by the RA V at its 14th session (Adelaide, Australia, 9 – 16 May 2006) with defined Terms of Reference, it has not yet had an initial meeting, and is lack of funding in WMO regular budget for the working group's meeting, there was general agreement on the need for the working group to have a meeting in the near future, or of a sub-group, to be referred to as the "core-team" of the working group's membership. In this connection, WMO Secretariat indicated that it will explore possibility to make available funding for a small 3 – 4 members core-team meeting, at a convenient location.
- 2) It was noted that there was some cross-membership between RA V WG/DRR and RA V/TCC. It was further noted that members of RA V WG/DRR need not be from the NMHSs. For example the current membership of the Solomon Islands is from the National Disaster Management Office (NDMO), and Niue has nominated its national disaster manager to represent Niue on the working group.
- 3) For more effective feedback between WMO DRR Programme and Members, a communication strategy at working group level would help to facilitate information among its members and between WMO DRR programme and Members.
- 4) The re-iteration of the importance of getting warning messages to the 'last mile' in Region V Members' communities, and the importance of robust operational and observational infrastructure, inter and intra island communication networks.
- 5) Many of their countries have emergency management legislation that includes defining the roles and responsibilities of National Meteorological and Hydrological Services (NMHSs). In this connection, concerns were expressed that the prominence and lead role of NMHSs, particularly in the issuing of warnings, may be lost in these arrangements.
- 6) It was noted that the disaster risk reduction inputs to any major regional weather services projects was essential – in the context of the philosophy of the end-to-end warnings process and that cooperation and contributions by the RA V WG/DRR in this regard were much appreciated.
- 7) The session agreed with the new WMO DRR programme delivery model of RPAG's and approved this as a way forward for the RA V WG/DRR group, emphasizing the need for the working group membership to act as national focal points for disaster risk reduction projects. It would therefore be essential that an efficient communication mechanism be developed that would facilitate information exchange both within the group and with the RPAG.
- 8) The discussion was closed with an acknowledgement that the 'brainstorming' session had been both informative and productive.

8.3.9 The session concluded with the following recommendations:

- 1) The current membership to be confirmed with Permanent Representatives (PRs) with WMO;
- 2) A core team (a sub-set of the RA V WG/DRR membership) to meet before the

end of the calendar year (2008) to discuss the adoption of the RPAG model as defined in Region IV and that an appropriate project be scoped for Region V;

- 3) The RA V WG/DRR Terms of Reference as given in Resolution 15 (XIV RA V) – Working Group on Natural Disaster Prevention and Mitigation in Regional Association V (South-West Pacific) to be reviewed with the aim of facilitating the works of the group and its members.
- 4) That an effective communication plan be developed to ensure: participation and buy-in of the entire group; that members, as national focal points, are fully informed of the group's developments and discussion; and that members can fully participate in group's discussions

9. DATE AND PLACE OF THE THIRTEENTH SESSION (Agenda item 9)

9.1 The Committee noted that its thirteenth session would be held back-to-back with the fifteenth Session of the Regional Association V (South-West Pacific) as being a practice with previous events. Indonesia offered to host the thirteen Session of RA V. However, the delegate of Vanuatu informed the Committee that his country is willing to host the thirteenth session of the RA V/TCC in 2010, if for some reasons could not be held back-to-back with the thirteenth session of RA V. The Committee welcomed the offer and requested the Secretary-General of WMO to take appropriate actions, in consultation with the president of RA V and the chairman of the Committee, to make necessary arrangements for the next session.

10. CLOSURE OF THE SESSION (Agenda item 10)

10.1 The report of the twelfth session of the Committee was adopted at its final meeting on 17 July 2008.

LIST OF APPENDICES

- APPENDIX I - List of Participants
- APPENDIX II - Agenda
- APPENDIX III - RSMC Nadi 2006/2007 and 2007/2008 Tropical Cyclone Season Summary
- APPENDIX IV - Reports on tropical cyclone activities in the South Pacific and South-East Indian Ocean areas during 2006/2007 and 2007/2008 seasons
- APPENDIX V - Updated Technical Plan and Implementation Programme (2008 – 2012)
- Appendix VI - Presentation on disaster risk reduction “brainstorming” session

APPENDIX I

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APPENDIX II

AGENDA

1. Organization of the session
 - 1.1. Opening of the session
 - 1.2. Election of the vice-chairperson
 - 1.3. Adoption of the agenda
 - 1.4. Working arrangement for the session
 2. Report of the Chairperson of the Committee
 3. Coordination within the WMO Tropical Cyclone Programme
 4. Review of the past tropical cyclone seasons (2006/2007 and 2007/2008)
 5. Review of the Tropical Cyclone Operational Plan for the South Pacific and the South-East Indian Ocean
 6. Review of the Committee's Technical Plan and Implementation Programme
 - 6.1. Meteorological component
 - 6.2. Hydrological component
 - 6.3. Disaster risk reduction component
 - 6.4. Storm surge advisory arrangement and coastal risk management
 - 6.5. Training component
 - 6.6. Research component
 7. Assistance required for the implementation of the programme for the development of services
 8. Other business
 - 8.1. Severe weather forecast demonstration project
 - 8.2. Support for Fiji
 - 8.3. Special session on disaster risk reduction
 9. Date and place of the thirteenth session of the Committee
 10. Closure of the session
-

1.3 Occurrences

A total of fifteen significant tropical disturbances were monitored and assigned numbers of the series (01F, 02F,.....etc) in the 2006/7 Tropical Cyclone Season by RSMC Nadi. Out of this fifteen only six reached tropical cyclone status. Three of these 6 cyclones originated about the Coral Sea region while the other 3 developed about or just east of the Dateline.

Table 1 Tropical Cyclones in the RSMC Nadi area of responsibility, for the 2006/7 Season. All dates and times are in UTC1.

Name	Low first identified			Initial tropical cyclone phase			
	Date	Lat.	Long.	Date	Time	Lat.	Long.
Xavier	20 Oct	09.4°S	167.6°E	21 Oct	1800	10.5°S	167.8°E
Yani	18 Nov	08.8°S	171.5°E	22 Nov	0000	12.3°S	162.4°E
Zita	20 Jan	11.5°S	165.5°W	22 Jan	1800	14.2°S	157.3°W
Arthur	20 Jan	12.2°S	177.0°W	24 Jan	0600	14.5°S	167.5°W
Becky	25 Mar	12.0°S	157.5°E	26 Mar	1200	13.1°S	163.0°W
Cliff	01 Apr	13.5°S	175.0°E	04 Apr	0600	17.2°S	179.4°W

Name	Maximum Intensity (knots)						End of Tropical Cyclone Phase			
	Date	Time	Lat.	Long.	Int	Cat.	Date	Time	Lat.	Long.
Xavier	24 Oct	1200	13.7°S	169.7°E	95	4	26 Oct	0000	14.7°S	170.3°E
Yani	23 Nov	1800	13.9°S	163.1°E	75	3	24 Nov	1800	13.2°S	162.6°E
Zita	23 Jan	1200	17.6°S	153.4°W	60	2	25 Jan	0000	31.0°S	149.1°W
Arthur	25 Jan	0600	16.3°S	159.1°W	60	2	27 Jan	1200	31.4°S	145.0°W
Becky	28 Mar	0000	18.0°S	167.4°E	60	2	29 Mar	0600	20.9°S	167.3°E
Cliff	05 Apr	1800	23.7°S	175.4°W	55	2	06 Apr	1200	27.4°S	168.4°W

1.4 Verification Statistics

Position forecast verification statistics for each cyclone (**Table 1.2**) was derived by comparing the initial and forecast positions (given in warnings issued by RSMC Nadi-TCC) with post analysis 'best track' positions. It is worth noting that the Australian Tropical Cyclone Workstation (ATCW) verification programme used by RSMC Nadi-TCC is sensitive to the number of forecast positions verified. Subsequently, short-lived cyclones could not be verified beyond 12-hour and/or 24-hours.

Overall, initial position errors for individual tropical cyclones were similar to previous Seasons. However, *Xavier*, an out of season cyclone and occurring in the Coral Sea region during a "transition" period, proved quite difficult to locate as it was constantly overshadowed by dense cirrus. *Zita*, a hybrid, was also difficult to locate with dense cirrus over the low-level centre, under a prevailing upper-level westerly flow.

Apart from *Xavier* and *Zita*, errors for all the individual cyclones at 12-, 24-, 36- and 48-hour forecast times displayed significantly poor forecast skills. With both cyclones, the significant errors were attributed to difficulties in Consensus forecasting the southward turn when the cyclone persisted on an east to southeast track.

Figure 1.3 RSMC Nadi Forecast Errors.

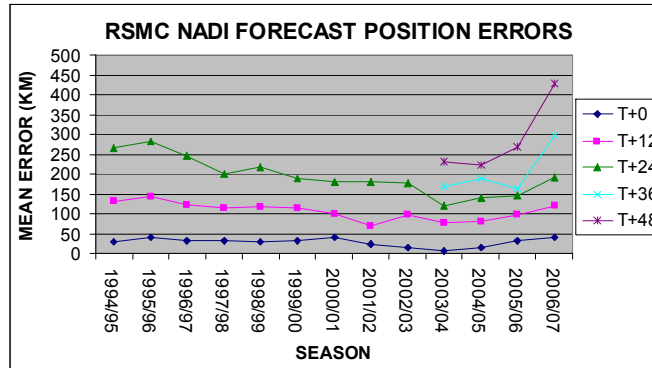


Table 1.2 Position forecast verification statistics for official warnings issued by RSMC Nadi. Forecast positions are verified against the official best track. Persistence errors (in brackets) are included for comparison.

Lead-time	0 hours		12 hours		24 hours		36 hours		48 hours	
Name	Mean error (km)	No.	Mean error (km)	No.	Mean error (km)	No.	Mean error (km)	No.	Mean error (km)	No.
Xavier	50	22	144(132)	15	240(217)	13	363(297)	10	461(367)	6
Yani	29	8	98(88))	10	168(121)	8	218(196)	6	-	-
Zita	54	16	209(202)	5	-	-	-	-	-	-
Arthur	37	25	119(150)	8	183(306)	6	337(497)	4	-	-
Becky	27	14	66(111)	8	123(285)	6	208(496)	4	-	-
Cliff	40	12	94(88)	6	207(275)	4	-	-	-	-
Aggregate	40	116	120(125)	52	192(249)	40	296(338)	24	430(437)	12

In **Table 1.3**, the radius of the circles (centred on the centroid of the errors) containing 50% of the operational initial positions, is smaller than 0.5 degree of latitude (55.5 km) for all cases. Therefore the location of systems could be summed up as falling within the category of "**Position Good**" for all the cyclones, except for *Xavier* and *Zita*..

The forecast error centroids and size of the radius of the 50% circle (centred on the centroid of the errors) indicate bias and consistency of bias in the forecast positions. For instance, *Xavier* consistently trekked east of its expected tracks, causing large westerly biases of the centroids. The very significant southwest bias displayed by *Xavier* at and beyond 24-hours was attributed to Consensus consistently forecasting a southwest track when the cyclone was steadily heading southeast.

Table 1.3 Centroid of errors for initial (0-hour lead time), 12-hour and 24-hour forecast positions given in warnings issued by RSMC Nadi with the radius of the circle enclosing 50% of the positions. All distances are in kilometres.

Lead-time	0 hours		12 hours		24 hours	
Name	Centroid E-wd, N-wd	Radius of 50% circle	Centroid E-wd, N-wd	Radius of 50% circle	Centroid E-wd, N-wd	Radius of 50% circle
Xavier	-35,-18	48	-19,-46	129	-121,-22	196
Yani	-9,11	33	-10,45	82	-73,45	119
Zita	-31,-6	52	-87,151	128	-	-
Arthur	-21,2	34	-76,-2	86	-133,37	131
Becky	-5,-2	26	18,15	47	54,69	68
Cliff	-34,5	34	-49,34	71	-133,147	136
Aggregate	-8,-1	44	-30,-1	119	-86,26	168

Table 1.3 Contd.....

Lead-time	36 hours	48 hours
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Name	Centroid E-wd, N-wd	Radius of 50% circle	Centroid E-wd, N-wd	Radius of 50% circle
Xavier	-288,50	175	-445,117	174
Yani	-187,13	105	-	-
Zita	-	-	-	-
Arthur	-233,111	234	-	-
Becky	86,147	6	-	-
Cliff	-	-	-	-
Aggregate	-197,81	206	-346,151	243

Figure 1.4 Tracks of Xavier, Yani, Zita, Arthur, Becky and Cliff.

1.5 Tropical Cyclones in the RSMC Nadi Area of Responsibility (AOR), 2006/2007 Season.

In the discussion that follows, distances are in nautical miles and wind speeds are 10-minute averages.

Xavier (01F): 20-26 Oct 2006

Xavier, an out-of-season tropical cyclone was the first to occur inside the RSMC Nadi AOR in the 2006/7 Season. The small cyclone originated along an active South Pacific Convergence Zone (SPCZ) that lingered for about a week across the Solomon Islands and the north of Vanuatu.

01F was first identified by RSMC Nadi as a persistent area of convection increasingly consolidating itself around 20/2100 UTC, to the north of Santa Cruz group, the eastern most group of islands in the Solomons. Late on the 21st, conditions rapidly turned favourable causing an explosive development. Subsequently, RSMC Nadi upgraded the system to cyclone and named it at 22/0000 UTC. However, on re-analysis, 01F attained cyclone status at 21/1800 UTC, when located over Santa Cruz group.

Through the 22nd, Xavier slowed, hovering over Santa Cruz, whilst steadily intensifying. It reached hurricane strength at 22/1800 UTC, 24 hours after becoming a cyclone. At this time, Xavier was also coming out of a small cyclonic loop and headed generally towards the southeast. With conditions remaining favorable for further development, the system continued to intensify, reaching a peak intensity of 95 knots with a central pressure of 930 hPa at 24/0600 UTC. The cyclone was then located about 120 nautical miles east of Vanua Lava in northern Vanuatu. Xavier continued southeast until 25/0600 UTC when it began to turn west and weaken under strong shear. It was eventually downgraded to a depression at 26/0000 UTC while located about 180 nautical miles east-northeast of Espiritu Santo and moving north-northwest about 8 knots. The remnant low-level cloud centre (llcc) was ultimately not discernible after 28/0000 UTC.

There were no casualties as a result of Xavier in the Solomon islands, except for

extensive damage to food crops and flooding in Tikopia. However, Radio New Zealand reported that overall damage at Tikopia was considered to be light given the circumstances. The cyclone side-swiped the eastern islands of Vanuatu, causing strong and gusty winds, rough seas and moderate to heavy swells.. It is fortunate that the southwest turn into Vanuatu, as continually predicted by Consensus did not eventuate when the system was intense. Damage could have been severe if it occurred.

Yani (04F): 22-24 Nov 2006

Tropical Cyclone Yani was the second cyclone to develop inside RSMC Nad's area of responsibility during the Season.

TD 04F was first identified as a weak disturbance around November 16th, embedded along the active SPCZ, that stretched from the Solomons to the Cook Islands. It was then located far to the east-northeast of Santa Cruz, Solomons, and moving generally westwards. Despite the existence of a well established westerly monsoonal flow to the north and a strong southeasterly wind surge to the south, TD04F was slow to consolidate. From late on 19th till the 21st, the depression became hovered to the south of Rennel island whilst executing a clockwise loop. Overnight of the 21st, convection erupted about the low-level cloud centre (llcc) with bands wrapping significantly around it. This also coincided with the llcc moving under the 250-hPa ridge where shear was also minimal. Further, the depression was also coming out of the cyclonic loop and taking a slow but definite southeast track. 04F was named Yani at 22/0000 UTC while located approximately 230 nautical miles to the southeast of Honiara, Solomon Islands.

Subsequent intensification was fairly rapid. 18 hours after being named, it attained storm strength. By 23/0600 UTC the cyclone achieved hurricane intensity. Yani reached peak intensity at 23/1200 with a central pressure of 960 hPa and a 10 minute-average wind of 75 knots. Peak intensity was maintained for 12 hours as the cyclone also took a more southerly track, under a poleward-oriented mid to high-level ridge pushing from the east. Soon after 24/0000 UTC, Yani ran into a strong northwest shear that tore away its central convective core to the southeast. As dissipation occurred, the cyclone was also turned initially northwest then northwest, by the strong subtropical ridge to its south. Yani was downgraded to a depression by 24/1800 UTC while on a westward course. The remnant llcc eventually dissolved in the Northern Coral Sea several days later.

There were no reports of any significant damage as a consequence of Tropical Cyclone Yani.

Zita (07F): 22 - 26 Jan 2007

Tropical Cyclone Zita (TD 07F) was the third tropical cyclone to form inside the Nadi AOR during the 2006/7 Season to the east of the Dateline.

TD 07F was first identified as a slow-moving and poorly-organised tropical disturbance on January 17th just northwest of Samoa, along the established and active SPCZ. Two other disturbances developed around this time, with TD 06F to the west, which moved away rapidly south-southeast as a highly sheared system, and TD 08F to the east, that later developed into tropical cyclone Arthur, soon after Zita's demise. For the following three days, though embedded in a favourable environment, diurnal influence was still significant. Overnight of the 20th, though, convection redeveloped over the system. Throughout the 21st and 22nd, despite diurnal variation, deepening persisted, with primary bands wrapping tightly around the llcc.

At 22/2100 UTC 07F was named Zita whilst located about 320 miles northeast of Rarotonga or 440 miles northwest of Tahiti and accelerating southeast about 14 knots. On retrospect, based on Dvorak and Zita should have been named 3 hours earlier at 22/1800 UTC. This poleward movement was assisted by the presence of TD 06F to its south-southeast, which effectively weakened the subtropical ridge lying to the south. Zita intensified rather rapidly to peak at storm force with 10 minute-average winds of 60 knots close to the centre and a central pressure of 975 hPa at 23/1200 UTC. At this time, it was located about 210 miles to the west of Tahiti, and heading south-southeast at 15 knots. However, as the cyclone trekked towards the Austral Islands, it ran into a region of cooler SSTs and stronger vertical wind shear, causing weakening. Zita was downgraded to and extra-tropical system at 25/0000 UTC, while lying far to the south of Tahiti.

Though the cyclone passed through the Austral islands, damage associated with Zita was minimal, which included some felled and uprooted trees and flooding along coastal roads.

Arthur (08F): 24- 28 Jan 2007

Arthur was a short-lived system that essentially took the same track that Zita had taken a few days earlier.

TD 08F was first identified as a tropical disturbance on the 21st of January some 320 miles west-northwest of Apia, Samoa, moving towards the east-southeast at 5 knots. Three days later, the depression began to accelerate towards the east-southeast, passing to the north of Samoa. Initial development was significantly influenced by diurnal variations and strong shear. From late on 22nd, gale warnings were issued for an area some 30 to 90 miles away from the centre in the northeast quadrant, moving with the depression. By 24/0000 UTC, significant development had occurred, with convection consolidating around the lcc, convective tops cooling and upper-level outflow improving. TD08F was named Arthur at 24/1200 UTC, though by re-analysis, it was evident that gales were present near the centre by 24/0600 UTC.

When named, the cyclone had gale intensity and was located approximately 300 miles east of Apia, Samoa. It was then moving east-southeast at 21 knots under a westerly steering field. Arthur intensified rapidly under a cyclonic vorticity advection (CVA) region with strong divergence and minimal shear. Cold convective bands wrapped tightly into the centre as outflow developed in all quadrants. A banding eye briefly formed and was observed to contract in satellite imagery. As the system was shuttled east-southeast, it passed within about 100 miles south of Suvarrow, the southern-most island of Northern Cooks and 150 miles to the north of Southern Cooks.

Peak intensity was attained at 25/0000 UTC with a maximum 10-min average winds of 60 knots and a central pressure of 975 hPa about 350 miles north-northwest of Rarotonga or about 650 miles west-northwest of Papeete, Tahiti. 6 hours later, strengthening shear tore away the cold convective tops to the southeast, leaving the lcc lagging behind. By 25/1200 UTC, the weakening cyclone took a southeasterly track and headed towards the Austral islands. As it continued further towards Wellington's AOR, it encountered waters already cooled by Zita a mere 48 hours prior. Wellington assumed the primary responsibility for warnings on Arthur from 27/0000 UTC as the system continued into the southern ocean. 12 hours later, it became extra-tropical, well into Wellington's AOR.

There were no significant reports of damage as a result of Arthur, apart from heavy rain in certain parts of French Polynesia, gusty winds and heavy sea swells in the Austral islands as the cyclone passed through.

Becky (13F): 26-29 Mar 2007

TD 13F was first identified as a tropical low by Brisbane TCWC in their AOR at 25/0000 UTC March 2007. This was through a gale warning issued at 25/0000 UTC on gales gradually developing within 180 miles of centre in the next 24 hours. The tropical LOW was then located approximately 210 miles southwest of Honiara on Guadalcanal, Solomon Islands and moving eastwards about 08 to 10 knots. Through the 25th, the system gradually developed whilst lying under an upper-level ridge axis with low vertical shear and favorable diffluence. 18 hours later, it entered into RSMC Nadi's AOR where it was designated TD 13F. RSMC Nadi maintained the gale warning commenced by Brisbane, mentioning winds increasing to gale force near the centre in the next 12 to 24 hours. The depression was then turning east-southeastward along the western periphery of a near-equatorial mid-level ridge to the northeast. Through the 26th, the lcc was consolidating with cold convective banding wrapping into it. Overnight, cold convective bands and outflow over the system improved significantly and by 26/1800 UTC, TD 13F was named *Becky* by RSMC Nadi. On reanalysis, with the descending Quikscat pass on the evening of the 26th, TD 13F should have been named at 26/1200 UTC. At 26/1800 UTC, the cyclone centre was located about 330 miles southeast of Honiara or 220 miles northwest of Santo, Vanuatu, and moving to the east-southeast at about 7 knots with 40 knots close to the centre.

After naming, Becky's track gradually veered from east-southeast to south-southeast, steered by the near-equatorial ridge to its east and a high-amplitude trough to its west This

change in track also spared the Vanuatu chain of islands from being directly hit by the cyclone centre. Becky gradually intensified to reach a peak intensity of 60 knots and a central pressure of 975 hPa at 27/1800 UTC. It was then located approximately 90 miles northwest of Port Vila and accelerating a little towards the south-southeast at 12 knots. Signs of weakening appeared around 28/0000 UTC with outflow becoming restricted and drier air continually entrained into the core. Additionally, absolute shear over the system rapidly increased as Becky began to slow down considerably and turn towards the southwest from 28/1200 UTC. By 29/0000 UTC Becky had weakened to a gale and six hours later, RSMC Nadi downgraded the system to a tropical depression. At this time, the exposed llcc was located east of New Caledonia and heading steadily southwest. By 29/1200 UTC the llcc was devoid of any deep convection.

No reports of damage or casualties resulting from Tropical Cyclone Becky have been received.

Cliff (14F): 04-06 Apr 2007

Tropical Disturbance 14F was first analysed by RSMC Nadi on April 1st 2007 as a weak system 130 miles to the southwest of Rotuma and drifting towards the southeast. Till the 3rd, the disturbance remained under a strong westerly shear, just south of a 250-hPa ridge axis. Late on the evening of the 3rd, it was upgraded to a depression whilst located 110 miles to the northwest of Labasa town, on Vanua Levu, the 2nd largest island in Fiji, and accelerating a little towards the southeast. By 03/1800 UTC, through microwave data, the llcc was still exposed to the northwest of the coldest convection. This area of deep convection was steadily moving over Cikobia and nearby smaller islands and rapidly approaching the northeast parts of Vanua Levu. Around 03/2100 UTC, wind shear relaxed sufficiently to allow the depression to consolidate. By this time, the llcc, was moving closer towards the area of deep convection with outflow over the system improving. After 04/0000 UTC, the deepening depression rounded the northeastern tip of Vanua Levu. By this time, convective bands were rapidly developing and wrapping into the llcc. At 04/0300 UTC, whilst located 60 miles to the east-southeast of Labasa and approximately 15 miles to the east-northeast of Taveuni, the 3rd largest island in Fiji, TD14F was upgraded to cyclone status, and named Cliff. By this time, though, winds of at least gale strength were present around the llcc but still some distance away from the centre. However, winds near the centre were rapidly increasing to gale force.

Once named, Cliff took a south-southeast through the Lau group picking up speed as it coursed through. Intensification gradually occurred with good equatorial and polar outflow and low to moderate upper-level shear. The peak intensity was attained at 05/1800 UTC with a central pressure of 980 hPa and maximum 10-minute average winds of 55 knots. The cyclone was then located about 150 miles south-southwest of Nuk'alofa, Tonga and poised to accelerate into Wellington's AOR under a strengthening northwesterly steering field. Cliff only lasted for 12 hours as a cyclone in Wellington's area, due to cooler seas and stronger wind shear environment. By 06/12/00 UTC, it became extra-tropical. The remnant depression continued to the southeast into open waters, eventually merging with a mid-latitude frontal boundary soon afterward.

Cliff caused extensive damage to crops, landslides from heavy intensity rainfall and flooding, minor damages to infrastructure, buildings and homes and disrupted communications and public utilities to certain areas in the eastern parts of Vanua Levu, Taveuni and nearby smaller islands. In the Lau group, damage to homes was minor but crops were severely affected. The total cost of damages caused by *Cliff* was approximately FJ\$6 million. There were no reports of any serious damages from the kingdom of Tonga.

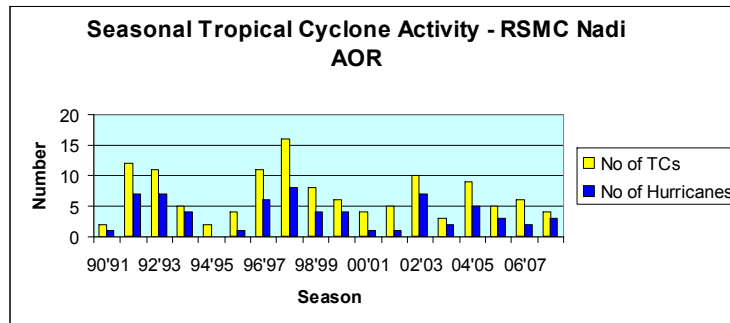
2. 2007-2008 Season

2.1 Introduction

A summary is presented of tropical cyclone activity during the 2007/2008 Tropical Cyclone Season for the Regional Specialised Meteorological Centre Nadi - Tropical Cyclone Centre (RSMC Nadi-TCC) Area of Responsibility (AOR) covering from Equator to 25°South Latitude and 160°East to 120°West Longitude. The official tropical cyclone season for this region commences on November 1st and ends on April 30th.

In the 2007/2008 Tropical Cyclone Season, tropical cyclone activity in the RSMC Nadi AOR was well below its climatological average. In total, only four tropical cyclones occurred in the region. Three of these cyclones attained hurricane intensity (two category 4 and one category 3) whilst the fourth, a storm (category 2).

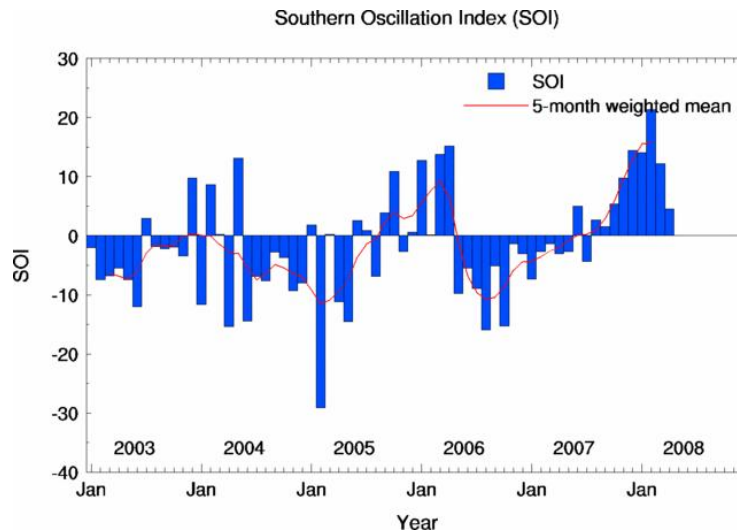
Figure 2.1 Tropical Cyclone Activity in RSMC Nadi AOR by Season



2.1 Climatic Indices

ENSO entered into a cool phase during the 2007/8 Tropical Cyclone Season with a well established La Niña. Subsequently, the monthly SOI values as well as the 5-month running mean remained positive throughout the whole period between November 2007 and April 2008 (refer **Figure 2.2**). Cloudiness around the near-equatorial dateline and further east in the Pacific was less than normal, corresponding to cooler than average sea-surface temperatures [SST] across that broad region. Cool anomalies in sub-surface water of the near-equatorial eastern and central Pacific persisted throughout the Season but extended westward into the central/western Pacific towards the end of the Season. Trade-winds in the near-equatorial Pacific were observed to be stronger than normal. The active MJO phase generally coincided with increased convective activity in the region. MJO periodicity became erratic in the second half of the season most probably influenced by La Niña .

Figure 2.2 Southern Oscillation Index values vs 5-Month Running Means



2.3 Occurrence

A total of sixteen significant tropical disturbances were monitored and assigned numbers of the series (01F, 02F,.....etc) in the 2007/8 Tropical Cyclone Season by RSMC Nadi. Only four out of these sixteen reached tropical cyclone status. Additionally, all four cyclones occurred in a two-month period, between the first week of December 2007 and the first week of February 2008. Furthermore, three of the four cyclones originated about the Dateline whilst the fourth developed in the Coral Sea region.

Table 2.1 Tropical Cyclones in the RSMC Nadi area of responsibility, for the 2006/7 Season. All dates and times are in UTC2.

Name	Low first identified			Initial tropical cyclone phase			
	Date	Lat.	Long.	Date	Time	Lat.	Long.
Daman	03 Dec	12.0°S	174.5°W	05 Dec	0200	12.1°S	177.7°E
Elisa	07 Jan	18.0°S	175.9°W	10 Jan	0000	21.4°S	175.6°W
Funa	15 Jan	16.0°S	162.0°E	16 Jan	0600	14.8°S	164.8°E
Gene	26 Jan	11.8°S	179.9°E	28 Jan	0600	17.4°S	178.4°E

Name	Maximum Intensity (knots)						End of Tropical Cyclone Phase			
	Date	Time	Lat.	Long.	Int	Cat.	Date	Time	Lat.	Long.
Daman	07 Dec	0600	15.5°S	178.6°E	100	4	09 Dec	0000	18.1°S	178.0°W
Elisa	11 Jan	0000	23.9°S	173.2°W	50	2	11 Jan	1200	24.6°S	170.7°W
Funa	19 Jan	0600	21.9°S	175.0°E	95	4	20 Jan	1800	21.6°S	169.1°E
Gene	01 Feb	0000	20.0°S	170.8°E	85	3	06 Feb	0600	29.9°S	174.8°W

2.4 Verification Statistics

Position forecast verification statistics for each cyclone (**Table 2.2**) was derived by comparing the initial and forecast positions (given in warnings issued by RSMC Nadi-TCC) with post analysis 'best track' positions. The Australian Tropical Cyclone Workstation (ATCW) verification programme used by RSMC Nadi-TCC is sensitive to the number of forecast positions verified.

Overall, initial position errors for individual tropical cyclones were similar to previous Seasons. However, relatively large errors associated with *Elisa*, and similarly with *Funa* and *Gene*, were attributed to difficulties in locating the centres which were constantly overshadowed by dense cirrus.

At 12-, 24-, 36- and 48-hour forecast times, forecasts consistently displayed good skill over persistence, for all cyclones. This was despite a relatively significant 12-hour forecast-time error with *Elisa*, due to difficulties in forecasting the southeast turn.

Figure 3.3 RSMC Nadi Forecast Errors.

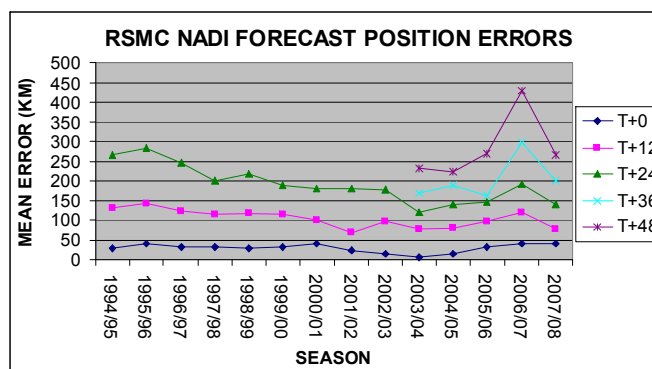


Table 2.2 Position forecast verification statistics for official warnings issued by RSMC Nadi. Forecast positions are verified against the official best track. Persistence errors (in brackets) are included for comparison.

Lead-time	0 hours		12 hours		24 hours		36 hours		48 hours	
Name	Mean error (km)	No.	Mean error (km)	No.	Mean error (km)	No.	Mean error (km)	No.	Mean error (km)	No.
Daman	27	28	74(111)	16	151(360)	15	226(622)	13	300(862)	11
Elisa	47	17	106(143)	5	-	-	-	-	-	-
Funa	41	18	83(86)	12	144(254)	10	223(519)	6	394(827)	2
Gene	43	34	69(97)	26	113(140)	24	181(245)	22	230(403)	18
Aggregate	39	97	76(105)	59	139(242)	52	201(411)	42	266(593)	31

In **Table 2.3**, the radius of the circles (centred on the centroid of the errors) containing 50% of the operational initial positions, is smaller than 0.5 degree of latitude (55.5 km) for all cases. Therefore the location of systems could be summed up as falling within the category of "**Position Good**" for all the cyclones.

The forecast error centroids and size of the radius of the 50% circle (centred on the centroid of the errors) indicate bias and consistency of bias in the forecast positions. For instance, *Gene* consistently trekked west-southwest, and then eventually southward, causing large westerly biases of the centroids at 24-, 36- and 48-hour forecast times. The very significant northwest bias displayed by *Funa* at, and beyond 12-hours, was attributed to forecasts consistently upholding a slower southwest track when the cyclone was steadily heading southeast.

Table 2.3 Centroid of errors for initial (0-hour lead time), 12-hour and 24-hour forecast positions given in warnings issued by RSMC Nadi with the radius of the circle enclosing 50% of the positions. All distances are in kilometres.

Lead-time	0 hours		12 hours		24 hours	
Name	Centroid E-wd, N-wd	Radius of 50% circle	Centroid E-wd, N-wd	Radius of 50% circle	Centroid E-wd, N-wd	Radius of 50% circle
Daman	8,2	37	-28,-28	59	-47,-93	99
Elisa	-18,-20	47	-73,-60	42	-	-
Funa	-23,5	35	-56,13	58	-110,49	81
Gene	17,-10	64	-44,-13	52	-95,-13	60
Aggregate	1,-6	54	-44,-16	59	-90,-27	105

Table 2.3 Contd.....

Lead-time	36 hours		48 hours	
Name	Centroid E-wd, N-wd	Radius of 50% circle	Centroid E-wd, N-wd	Radius of 50% circle
Daman	-99,-148	121	-165,-212	114
Elisa	-	-	-	-
Funa	-146,126	68	-201,178	102
Gene	-169,0	80	-229,15	113
Aggregate	-144,-22	124	-205,-26	153

Figure 2.4 Tracks of Daman, Elisa, Funa and Gene.



2.5 Tropical Cyclones in the RSMC Nadi Area of Responsibility (AOR), 2007/2008 Season.

In the discussion that follows, distances are in nautical miles and wind speeds are 10-minute averages.

Daman (04F): 05 - 09 Dec 2007

Daman was the first cyclone to occur inside the RSMC Nadi AOR in the 2007/8 Season. The cyclone was notable for its compact size as well taking an abrupt turn from a southward track to one of due east course late on the 6th. This sudden turn also spared the largest island in Fiji, Viti Levu, from the full brunt of the cyclone. Unfortunately, this change in track brought the centre right over or very close to Cikobia, an island lying a few miles to the north Vanua Levu.

TD 04F was first identified by RSMC Nadi as a persistent area of convection increasingly consolidating itself on the 3rd of December, about 200 miles northwest of Apia, Samoa, or approximately 540 miles northeast of Suva, capital of Fiji. At this time, the system was lying under an upper 250-hPa outflow, in an area of minimal vertical shear and warm SSTs. For the next 48 hours, with little change to the surrounding conditions, the depression steadily intensified whilst moving steadily westwards about 10 knots. On the 5th, convective bands were spiraling into and wrapping tightly around the low-level centre whilst cooling. Additionally, outflow over the system was good to the north and south. Subsequently, by 05/0200 UTC, the system was named *Daman*, with an estimated intensity of gale. The cyclone centre was then located about 50 miles east-northeast of Rotuma and beginning to turn west-southwest at 10 knots.

A little after 05/0600 UTC, the system moved across Rotuma island. However, 6 hours later, it made yet another turn, this time, towards the south-southwest. By 05/1800 UTC, the cyclone was upgraded to a storm. Soon after 06/0600 UTC, whilst located about 180 miles north-northwest of Nadi and tracking southwards, *Daman* made an abrupt turn, heading due east. As it did, the cyclone essentially put Cikobia island, the northern-most island of the Fiji group and lying due north of Udu Point, Vanua Levu, directly in its path. At this time as well, an approaching short-wave upper trough upstream of the cyclone enhanced the associated outflow over the system. Convection also cooled further, and by 06/1200 UTC, spotting a

cloud-filled eye, the cyclone's intensity was raised to hurricane force. The cyclone steadily intensified to reach peak strength by 07/1200 UC, with a central pressure estimated at 925 hPa and a maximum 10-minute sustained wind of 100 knots near the centre. Accelerating a little, the cyclone began to turn towards the southeast, staying just east of the Northern Lau group, Fiji. During the 8th, *Daman* took another turn towards the south, under a mid-level ridge to the southeast. Slowing a little, weakening set in quite quickly with strengthening vertical shear and cooler SSTs. By 08/1200 UTC it had weakened to a storm and 12 hours later, gale. The cyclone was downgraded into a tropical depression by 09/0600 UTC, whilst tracking south-southwest, through the southern island of the Lau group. The remnant of 04F was eventually lost into a quasi-stationary front to the south after the 10th, under hostile conditions.

Daman did its most damages on Cikobia island, with a population of 119. Damage to houses, school buildings, crops, fruit-bearing trees and foliage was extensive. Water pipes were damaged by felled trees. No life was lost to *Daman*. There were no reports of wave damage to coastlines anywhere in Fiji. The cost of damages was FJ\$0.5 million.

Elisa (07F): 10 - 11 Jan 2008

Tropical Cyclone Elisa was the second cyclone to form in the RSMC Nadi AOR during the 2007/8 Season. It was a relatively short-lived system, maintaining tropical cyclone characteristics for only about 42 hours. The depression from which Elisa developed was first identified about 115 nautical miles west-northwest of Vavau, Tonga at 07/1800 UTC, moving slowly southwards. The system was then poorly organised, embedded in an active and slow moving trough in a moderately sheared environment. Within the next 12 to 24 hours, against diurnal variation and hostile shear, significant development occurred, albeit at gradual rate. The system was eventually named *Elisa* at 10/0000 UTC, whilst located about 30 miles west-southwest of Nukualofa, the capital of Tonga. With shear decreasing somewhat, *Elisa* subsequently intensified and attained storm force winds while still moving southward at 05 knots. Peak intensity was achieved at 11/0000 UTC with the central pressure estimated at 980 hPa and maximum 10-minute average winds of 50 knots. At 10/1200 UTC, the cyclone re-curved southeast, into a region of stronger vertical shear and cooler waters. It was downgraded to a depression at 11/1800 UTC.

Heavy rain associated with the *Elisa* caused damages mostly to fruit bearing trees in Tongatapu and Eua. Additionally, associated high seas moved small vessels and fishing boats ashore in Nuku'alofa. Fortunately, there were no fatalities.

Funa (10F): 16 - 19 Jan 2008

Tropical Cyclone *Funa* was a rapid developer. TD 10F was first identified as a Tropical at 15/0600 UTC, embedded in an active monsoon trough extending from northern Australia, through northern Vanuatu to the north of Fiji. By the time, the surrounding environmental pressure was observed to be lower than usual. The disturbance was then lying about 300 miles west of Espiritu Santo Island, Vanuatu, and moving slowly eastwards, under a diffluent region. 24 hours later, with shear slackening a little, the system intensified to reach cyclone status and was then named, at 16/0600 UTC.

As it crossed eastwards across the northern tip of Espiritu Santo, the cyclone began to curve southeast under the influence of a mid-level ridge to the east and subsequent northwesterly steering field. With outflow over the cyclone increasing, *Funa* intensified further, as it moved over waters to the east of Vanuatu. By 18/0000 UTC, the cyclone reached hurricane intensity with 10-minute average winds of 70 knots close to centre. 6 hours later, a cloud-filled irregular eye was observed. The passage eastwards of an upper trough across the cyclone ignited a period of rapid intensification, attaining category 4 status by 19/0000 UTC. *Funa* reached peak intensity with a central pressure 930 hPa and 10-minute average winds of 95 knots close to the centre at 19/0600 UTC whilst moving south-southeast at 12 knots and expected to accelerate further. With this turn of speed, influenced by a strong northwesterly steering regime, it was anticipated that the centre would be inside New Zealand's AOR by 19/1800 UTC. Wellington did take over primary responsibilities for warnings on *Funa* at 19/1800 UTC with the centre well into their AOR.

Severe damage occurred over the groups of islands in the Torba, Sanma and Penama provinces of Vanuatu, particularly on dwellings (made of local material), trees and crops. Over

the Banks group, coastal villages were reported to have been inundated by sea flooding, while in Maewo, there was evidence of sea flooding. On Motalava and Rah islands, as well as Gaua in Santa Maria island, bungalows, resorts and restaurants along the coast were either washed away or inundated by sea flooding, according to their provincial council reports. Most schools in the Torba and Penama provinces sustained major damages to classrooms and other semi-permanent structures, while other buildings had their roofs ripped off. There were no reports of any fatalities but minor casualties were confirmed. No damage report on Espiritu Santo has been received, to date.

Gene (12F): 28 Jan – 03 Feb 2008

Severe Tropical Cyclone Gene was an unusually long-lived tropical cyclone, though not rare for the Southwest Pacific basin. The cyclone maintained tropical cyclone status south of 25 South in Wellington's AOR for two and a half days (2½) before turning extra-tropical.

Tropical Depression TD 12F was first identified by RSMC Nadi as a weak disturbance on the 26th of January, with a weak centre located some 180 miles east-northeast of Rotuma, moving south-southeast. Throughout the 27th, TD 12F made steady but significant intensification under minimal shear and developing upper outflow whilst also turning south-southwest towards Fiji. Between 27/1800 UTC and 28/0000 UTC, the depression turned southwest hugging the east and then southern coastline of Vanua Levu, under a mid-level ridge to the southeast. During this period as well, Quikscat confirmed 10-minute average winds of at least 30 to 35 knots within 30 to 60 miles away from centre in the southeast quadrant moving with the depression. Though the large scale conditions were still conducive to further development, the effects of the topography of Vanua Levu effectively hindered the spin-up of the system, thus delaying the development of gales near the centre. However, by 28/0600 UTC, as the centre moved across the Bligh Waters, convection markedly erupted about it, with tops cooling significantly. In retrospect, TD 12F should have been named at this later time, but for humanitarian reasons, it was named *Gene* 6 hours earlier. During the night hours of the 28th, the cyclone tracked over Viti Levu making an entry on the northeast side and exit almost directly overhead of Nadi late in the evening, whilst also turning west-southwest over the Mamanuca Group. As it moved over water, it was upgraded to a category 2 cyclone at 29/0000 UTC, but due to moderate vertical shear, intensity was lowered briefly to category 1 at 29/1200 UTC. By 29/1800 UTC, environmental conditions improved and Gene began to re-intensify, reaching hurricane status at 30/1200 UTC, while located about 240 miles east-southeast of Port Vila, Vanuatu.

The cyclone continued to slowly intensify as it trekked west-southwest. It reached a peak intensity of 10-minute average winds of 85 knots and a central pressure estimated at 945 hPa at February 01/0000 UTC. At this time, the centre was located approximately 200 miles southeast of Port Vila, after making an abrupt southerly turn, thereby removing the real threat to the southern islands of Vanuatu. 12 hours later, *Gene* began to weaken slowly and was eventually downgraded to storm intensity at 02/1200 UTC, while turning south-south-east and anticipated to accelerate into Wellington's AOR.

Interestingly, as *Gene* crossed into New Zealand's area of responsibility, it re-intensified, forming a large irregular and cloud-filled eye with a diameter of approximately 60 miles. The cyclone at this time was located about 420 nm southeast of Noumea, New Caledonia. The resurgence in strength, however, was short-lived, lasting for only about 12 hours. Once inside Wellington's AOR, *Gene* gradually curved towards the southeast and later east-southeast. As the cyclone underwent extra-tropical transition it regained hurricane intensity of 65 knots at 06/0000 UTC. 6 hours later, though, it was classified extra-tropical, continuing as a significant low. The remnants of *Gene* continued to move steadily on a general east-southeasterly track as it slowly weakened.

Six lives were lost in Fiji during *Gene*'s passage, 2 to drowning, 1 while fishing, 1 to fire burns, 1 to cancer complications and the sixth during sleep. Significant damage was inflicted on homes, infrastructure, public utilities, education, health, agriculture and forestry. The total cost of the damages caused by *Gene* was FJ\$51 million, according to the National Disaster Management Council (DISMAC) Task Force Report.

References:

1. **Australian Bureau of Meteorology web site**, <http://www.bom.gov.au/>, for Monthly SOI values and 5-month running mean, from 2002 to 2007.
2. **Padgett G and Padua M.V.**, Global Monthly Tropical Cyclone Activity Summary.
3. **Fiji National DISMAC**, Damage Report on Tropical Cyclone Cliff.
4. **Fiji National DISMAC**, Damage Report on Tropical Cyclone Daman.
5. **Fiji National DISMAC**, National Task Force Report on Tropical Cyclone Gene.

APPENDIX IV

**Reports on Tropical Cyclone Activities in the South Pacific and
South-East Indian Ocean Areas During 2006/2007 and 2007/2008 Seasons**

(Country Reports are attached separately)

APPENDIX V

RA V Tropical Cyclone Committee's Technical Plan and its Implementation Programme

(2008 – 2012)

GOAL: To Provide a Range of Training and Capacity Building Opportunities

Elements	Rating	Strategies	Key Stakeholders*	Potential Resources	Performance Target	Focal Point	Progress: 2006-2008+	Remarks
Satellite product interpretation training	Essential	To take advantage of satellite training workshops and courses where possible	Members requiring these skills	WMO	Opportunities taken where available	WMO	Satellite training workshop held in Melbourne in October 2006. Training course for Region V on environmental satellite data October 2007 in Melbourne, Australia.	Now looking for ongoing opportunities
Upgrade qualification training	Very Desirable	Determine feasibility of a basic meteorology course for trainees with lower entrance qualifications	Kiribati, Niue, Samoa and Tonga.	To secure funding.	Feasibility and planning in place by 2010	WMO		Longer-term to set up course
Tropical cyclone forecasters mentor training	Very Desirable	To conduct mentoring missions	Niue, Indonesia and Vanuatu.	To secure funding	At least 2 visits.	WMO/Chair RA V /TCC	1 mentor training for Indonesia in 2007.	
RSMC/TCWC attachment training	Essential	To send forecasters to either RSMC Nadi, Australia TCWCs or RSMC Honolulu (Pacific Desk)	All Members	WMO and USA	Minimum of 5 per year.	WMO/ SPREP	Eleven candidates participated in the Pacific Desk Training Programme during the period April 2006 to July 2008. Two candidates participated in attachment training at RSMC Nadi in 2007.	

* Lists of RA V/TCC members are indicated in Attachment I to the Technical Plan

+ A summary of training courses completed, planned and Members' requirements are included as an Attachment II to the Technical Plan

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Elements	Rating	Strategies	Key Stakeholders*	Potential Resources	Performance Target	Focal Point	Progress: 2006-2008+	Remarks
Media skills training	Very Desirable	To conduct a workshop in 2009, including other related initiatives.	10 Pacific Member Countries	JICA and WMO	Workshop completed.	WMO and Fiji	Cook Islands has implemented a system for meteorologists to provide TV weather presentations.	Skills in TV, radio and newspaper interviews
Management training	Very Desirable	To provide management training to NMHSs managers.	Members requiring these skills	WMO	Appropriate courses targeted.	Chair RA V/ TCC		
Information technology training: web page development	Completed							
Technical maintenance training								
• Workshops	Workshops Completed	To organise a workshop					Workshop held in Melbourne, Australia in 2007	
• In-country visits	Essential	To send technician(s) with a wide range of skills into needy countries	Members requiring technical training	Australia, New Zealand, USA, UK	Minimum of two engineers visits	Met Service New Zealand Ltd	Ongoing work being done by MetService New Zealand Ltd	

GOAL: To Upgrade Communications and Computing Capabilities

Elements	Rating	Strategies	Key Stakeholders*	Potential Resources	Performance Target	Focal Point	Progress: 2006-2008	Remarks
Satellite technologies <ul style="list-style-type: none"> • Transition to LRIT • Upgrade to high resolution capability 	Essential	To purchase and install appropriate hardware and software	Members in need of WEFAX replacement	WMO	All those in need upgraded to LRIT	WMO	Plans in place for purchase of equipment in latter half of 2008 and installation shortly thereafter	
	Completed							
Communications including WIS <ul style="list-style-type: none"> • Emergency Equipment • RANET • ISCS/WAFS 	Essential	To equip with suitable backup communications	Members without backup	Where able to be secured, possibly NOAA & USAID, AusAid	All Members with alternative communications	Pacific RANET Committee and WMO	Satellite phones purchased for: Niue, Tuvalu and Kiribati via MetService New Zealand Ltd. Short-wave receivers into Tonga, Vanuatu and Samoa (proposal submitted) LRIT to work here	Need clarification from RANET
	Very Desirable	To expand existing network	Members in need		2 new installations		Good progress is being made	
	Lapsed						Not viable for GTS in RAV	Is GTS backup in Central America
Upgrade Information technology capability <ul style="list-style-type: none"> • Operational PCs, workstations and servers 	Very Desirable	To replace with or install up-to-date computer facilities.	Kiribati, Solomon Islands and Tonga.	To be secured.	Software and hardware to support at least Win-XP	WMO	Ongoing	

GOAL: To restore, upgrade, maintain, calibrate, enhance and sustain observational networks

Elements	Rating	Strategies	Key Stakeholders*	Potential Resources	Performance Target	Focal Point	Progress: 2006-2008	Remarks
<p>Observations Networks</p> <ul style="list-style-type: none"> Restore, upgrade, maintain, calibrate, expand and sustain RBSN 	Essential	To support Pacific GCOS, GUAN & GSN stations	Members with basic set-ups*	WMO/SPREP MetService (NZ), NZAID, UK Met Office, UK Foreign and Commonwealth Office (UKFCO), US NOAA GCOS Regional technical support programme (NPAC, Pacific Fund (PF), and Technical Support Project (TSP), JICA, Australia, Meteo France	At least two countries with upgraded networks.	WMO /SPREP Met Service (NZ)	<p>MetService New Zealand Ltd have already restored and upgraded five Pacific Island GUAN stations (Honiara, Bauerfield, Port Moresby, Rarotonga and Penrhyn).</p> <p>Provision of basic equipment for surface observations to eleven Pacific Islands.</p> <p>Kiribati WMO VCP funded project to be completed by end of 2008. Funded by the Australian Bureau of Meteorology.</p> <p>Daily remote technical assistance and at least 14 in-country emergency, preventative and routine maintenance and technical support visits to eleven Pacific Islands (Cook Islands, Kiribati, Tuvalu, Solomon Islands, PNG, Fiji, Vanuatu, Tokelau, Samoa, Tonga, and Pitcairn Islands).</p> <p>Two GUAN stations in Papua New Guinea were reactivated, but the other GUAN station not on plan.</p>	
<ul style="list-style-type: none"> AWS 	Essential	To restore, upgrade, enhance and sustain AWS network across RA V TCC area		MetService (NZ), US GCOS NOAA and Met Office UK, NIWA, JICA, Australia, Meteo France	4 additional AWSs installed		<p>Two new AWS (mSTARs) for Kiribati (Tarawa and Christmas Island).</p> <p>Upgrade AWSs on Tokelau and Pitcairn Island.</p> <p>MetService New Zealand Ltd will upgrade and restore five AWS for Fiji during 2008/2009.</p>	

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Elements	Rating	Strategies	Key Stakeholders*	Potential Resources	Performance Target	Focal Point	Progress: 2006-2008	Remarks
Adaptive observing systems <ul style="list-style-type: none"> Aeroclipper 	Very Desirable	Investigate viability and logistics of the aeroclipper and similar systems for possible implementation in Region V.			Report on viability by 2010			May provide DVORAK validation
Regional Maintenance <ul style="list-style-type: none"> Maintain surface and upper air networks 	Essential	To fix ongoing problems & bring up to an acceptable standard	Members requiring assistance*	MetService (NZ), Met Office UK, US NOAA GCOS, NZAID	At least 90 % of all GUAN/GSN observations from 11 Pacific Islands are received on time, quality controlled and transmitted on the GTS by MetService New Zealand Ltd on a daily basis.	MetService New Zealand Ltd.	Unknown	Develop performance record from NZ 4'ly reports
<ul style="list-style-type: none"> Enhance and broaden GCOS RMC 	Essential	To facilitate roving technical support	Members requiring support*			MetService New Zealand Ltd is currently serving as a defacto regional maintenance and technical support centre		

GOAL: To Upgrade Forecasting and Warning capabilities

Elements	Rating	Strategies	Key Stakeholders*	Potential Resources	Performance Target	Focal Point	Progress: 2006-2008	Remarks
• Tropical cyclone module	Essential	To install and maintain the software.	Members with forecasting capability.	AusAID and WMO	Installation of software in PNG.	Chairperson of RA V/TCC	Installed in all but Papua New Guinea and New Zealand.	To make a formal request to Director of the Australian Bureau of Meteorology.
• Graphical TC warning products	Very Desirable	To develop appropriate graphics in conjunction with Emergency Management Organisations	RSMC/TCWC, French Polynesia and New Caledonia	AusAID, WMO and France.	Availability of graphical products for all Members.	Chairperson of RA V/ TCC	Some developments by Indonesia, Fiji on the tropical cyclone module.	Requires an appropriate software to begin with – longer term
• Access to global NWP models and consensus TC track forecasts	Essential	To assist access to global NWP output	Members with forecasting capability	WMO	RSMC/TCWCs have access to available NWP	Chairperson of RA V/ TCC.	JMA data now available to Members.	Web page
• Development of probabilistic forecasts	Very Desirable	To utilise ensemble and climatological data to develop probabilistic fields for winds, rainfall	Members with forecasting capability.	USA and Australia	Probabilistic graphical forecast by Nadi by 2009/2010.	Chairperson of RA V/TCC	Australia, Indonesia and USA (Hawaii).	
• Combined storm surge and wave models	Essential	To develop an effective forecasting system to provide reasonable forecasts for inundation caused by impacting tropical cyclones (storm tide and waves) and tropical cyclones at a distance (swells).	Vulnerable Members.	WMO, SOPAC, New Zealand and Tonga.	Task team formed, to set plans and report on progress made on the system.	WMO	No progress on original plans	Change of focus following EC-LX direction in wake of Myanmar disaster.
• Tropical cyclone warning verification	Very Desirable	RSMCs and TCWCs reports contain verification statistics.	RSMCs and TCWCs	WMO	Reports completed for RA V/TCC 2010 and beyond	WMO	Tropical cyclone module contains verification.	
• WMO TC forecaster web site	Very Desirable	To increase range of information available on web site.	All Members.	WMO	RA V/TCC members catered for	WMO	To be implemented by June 2009.	

GOAL: To Strengthen Ties to Disaster Risk Reduction

Elements	Rating	Strategies	Key Stakeholders*	Potential Resources	Performance Target	Focal Point	Progress: 2006-2008	Remarks
• Post tropical cyclones' impacts assessments	Very Desirable	To rework Attachment 8B in TCOP; and to participate in a project - Post Tropical Cyclones Impacts Assessments.	All Members	WMO CBS SWFDP.	Attachment 8B to be revised by the 13 th session of RA V/TCC; and to be involved in a project before 2010	Chairperson of RA V/ TCC.		
• Public awareness and education	Very Desirable	To develop suitable materials to assist in public awareness campaigns	All Members	WMO	Completion of task.	Chairperson of RA V/ TCC.	No progress.	
• Programs in cooperation with NDMOs	Essential	To run a regional workshop; and to conduct in-country training between NMHSs and NDMOs officials. Extension of RAV/TCC meetings to include disaster mitigation officials from Member nations – combining with Regional national disaster managers' meeting.	Members/ Disaster officials	WMO	One initiative completed. The 13 th session of RA V/TCC in 2010 include a DRR component and a DRR meeting	Chairperson of RA V/TCC.		
• Economic Impacts	Essential	To conduct a study on the economic and social impacts of tropical cyclones on SIDS in the Pacific region.	LDC/SIDS	WMO	Study completed	Chairperson of RA V/ TCC.		Similar case study carried out in 2005 for the Philippines.

GOAL: To Promote Research into Tropical Cyclones and Facilitate Timely Transfer to Operations

Elements	Rating	Strategies	Key Stakeholders*	Potential Resources	Performance Target	Focal Point	Progress: 2006-2008	Remarks
Operational Research <ul style="list-style-type: none"> Tropical cyclone track and intensity forecasting 	Essential	To assess and evaluate existing and new techniques (especially related to midget tropical cyclones); and to provide input on projects aimed at reducing forecast track and intensity errors.	RSMCs and TCWCs		Transfer into forecast and warning centres of improved track and intensity forecasting techniques.	RSMCs and TCWCs,	Consensus forecast: Fiji Australia Indonesia	
Support of student tropical cyclones research	Very Desirable	To support student research into tropical cyclones at local Universities.	Members with University links.	WMO	Scientific publications by these students.	Chairperson of RA V/TCC.		
Climate Research <ul style="list-style-type: none"> Quality of Region V section of the southern hemisphere tropical cyclone database TC climatology and: <ul style="list-style-type: none"> seasonal prediction scheme Intra-seasonal Forecasting 	Essential	To eradicate as many of the flaws as possible amongst the existing dataset	Australia, New Zealand, New Caledonia, Fiji and USA	Australia and New Zealand.	To present progress report at 9 th International Southern Hemisphere Atmospheric and Oceanographic Conference	Australian Bureau of Meteorology National Climate Centre and MetService New Zealand Ltd.	Obvious errors fixed – but detailed re-analysis required to validate any long term trends.	TCP/WRRP project will take this forward In a global TCDB
	Complete	Using the TC database, construct an up-to-date TC climatology and develop a TC seasonal forecasting scheme					NZ/AUS in place	
	Very Desirable	MJO based technique to be supported	All Members (south of the Equator), RA V WG on Climate Matters	NZ, New Caledonia, Australia	System being used in forecasting	Chairperson of RA V/TCC		WEB Site In Place

GOAL: To Support Important Initiatives and Activities of Relevance to RA V/TCC

Elements	Rating	Strategies	Key Stakeholders*	Potential Resources	Performance Target	Focal Point	Progress: 2006-2008	Remarks
RA V TCC Contingency Trust Fund	Very Desirable	To develop a feasibility plan to implement a RA V TCC Contingency Trust Fund	All Members	All Members	Feasibility plan presented at RAV TCC in 2010	Chairperson of RA V/TCC		
Comprehensive review of the TCOP	Very Desirable	Subcommittee to review and rewrite the existing TCOP	All Members	WMO	Completed draft to be part of documentation for 13 th Session in 2010	Rapporteur for subcommittee	Incomplete	^Subcommittee: RA V Chair, Arona Ngari (Cook Is), Ross Marsden (NZ), Ragendra Prasad (Fiji)
IWTC-VI in Costa Rica, November 2006	Complete	To maximise the number of suitably qualified operational forecasters attending	All members	WMO	At least 3 forecasters	WMO	More than three attended	
Bilateral cooperation between Indonesia and Australia	Very Desirable	Australia to provide continued support to the Jakarta TCWC	Australia and Indonesia	Australia	Ongoing support provided		Indonesia has successfully launched the Jakarta TCWC, Ongoing support required.	
Cooperation with other Working groups in RA V	Removed	To exchange information with other Working Groups						Normal procedure

The following Elements were rated as Desirable in 2006 and therefore were to be duly considered in strategic planning exercises:

Element	Rating (06/08)	Status – 2008
<ul style="list-style-type: none"> • Management Training • Weather Radars • Lightning Detectors • Research into structure of ‘midget’ TCs • Support of student TC research 	<p>Desirable</p> <p>Desirable</p> <p>Desirable</p> <p>Desirable</p> <p>Desirable</p>	<p>Upgraded to Very Desirable</p> <p>No change</p> <p>No change</p> <p>Upgraded to Very Desirable in research component within track & intensity forecasting</p> <p><i>Upgraded to Very Desirable</i></p>
<ul style="list-style-type: none"> • Update of Acronym List 	<p>Desirable</p>	

ATTACHMENT I -List of RA V/TCC members referred to in the Technical Plan

Member	Australia	Cook Islands	FSM	Fiji	French Polynesia	Indonesia	Kiribati	New Caledonia	New Zealand	Niue	Papua New Guinea	Samoa	Solomon Islands	Tonga	USA (A/Samoa)	USA (Hawaii)#	Vanuatu
RAV Members	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Members with forecasting capability	X				X	X	X?	X	X		X	X		X	X	X	X
RSMCs – TC				X												X	
TCWCs	X					X			X		X						
Members need satellite training				X	X	X	X	X			X	X	X	X	X		X
Members need management training			X			X	X			X	X	X	X	X	X		X
Members need technical training		X		X		X	X			X	X	X	X	X	X		X
Members need WEFAX replacement							X				X		X				X
Members without backup communications											X		X				X
Members need RANET support			X	X			X			X	X		X				
Members need repairs to surface stations		X		X			X			X		X	X				
Members need repairs to upper air stations		X		X							X						
Members need roving to support for stations		X		X			X			X		X	X	X			
Members vulnerable to inundation			X	X	X			X	X				X	X	X	X	
Members with links to Universities for research in TCs		X	X	X	?+	X	X	?^	X		X	X		X		X	X

#: Northern Hemisphere +: New Caledonia ^: Maybe in France

ATTACHMENT II – Training Summary

Courses Attended 2006-2008

- *International Pacific Desk Training Programme - Honolulu RSMC/WFO*: Cook Is, Kiribati (2), Indonesia, New Caledonia, Niue, Samoa, Solomon Is (3), Tonga, Vanuatu
- *Attachment Training – Nadi RSMC*: Niue and Tonga.
- *WMO Southern Hemisphere Tropical Cyclone Training Course (Melbourne, September 2007)*: Indonesia(2), New Caledonia, PNG, Samoa, and Tonga.
- *Meteorologist Course (Bureau of Meteorology, Melbourne, Australia)*: Fiji (3).
- *Meteorologist Course (Pune University, India)*: Vanuatu
- *Weather Forecasting Course (RSMC Nadi, Fiji)*: Cook Is, Kiribati, PNG, Samoa, Tonga (+ 4 others).
- *Meteorology Training Course - Tropical Meteorology & Ensemble Prediction Schemes (Noumea, New Caledonia)*: Cook Islands, Fiji, FSM, Kiribati, Niue, PNG, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu.
- *Marine Meteorology Training Course (Tahiti, French Polynesia October 2007)*: Australia, Cook Islands, New Zealand, Solomon Is (+9 others)
- *Training to enable Jakarta TCWC (Indonesia)*
 - *Train the Trainer*: (2 participants)
 - *IT Systems*: (3 participants)
 - *Forecaster Training*: (10 participants)
 - *Jakarta TCWC application training*: (5 participants)
 - *Attachment training in Darwin*: (4 participants)
- *Bureau of Meteorology (BoM) and Japan International Cooperation Agency (JICA) Climate Workshop*: Kiribati
- *APSAT (Melbourne, Australia, 2006)*: New Caledonia, Samoa, Solomon Is
- *Attachment to Meteo France and training Toulouse*: Some New Caledonia staff
- *Regional Workshop on Storm Surge and Wave Forecasting (Philippines, September 2006)*: PNG, Samoa
- *Tropical Cyclone Module/DVORAK Training by BoM staff*: Vanuatu

Courses and Attendance Planned 2008-2009 (€ = Not Confirmed)

- *International Pacific Desk Training Programme (Honolulu RSMC/WFO, Hawaii)*: Niue[€],
- *Regional Training Course in Aviation Meteorology (Noumea, New Caledonia, October 2008)*: Cook Is, FSM[€], Vanuatu (+ up to 12 others)
- *Meteorologists Course (Victoria University, Wellington, New Zealand, 2009)*: Vanuatu, FSM[€], Kiribati[€]
- *Meteorologist Course (Bureau of Meteorology, Melbourne, Australia)*: Fiji (3-4 in 2009, 3 in 2010), Vanuatu
- *Foundation Observer Course (RSMC Nadi, Fiji)*: Samoa, others TBA
- *JICA funded training in social communication/marketing (RSMC Nadi, Fiji, Mid 2009)*: 10 PICs
- *Training in Severe Weather Forecast and Related Warnings Issues (Tahiti, French Polynesia, October 2009)*
- *Ongoing enabling training for Jakarta TCWC staff*:
- *Training Course on Satellite Meteorology (India, Aug 08 – Apr 09)*: PNG
- *Weather Service Specialists/Observers in PNG*: PNG(5)
- *Seminar in Weather Administration (China, September 20 08)*: Samoa
- *Storm Surge & Wave Forecasting (Noumea, New Caledonia, November 20 08)*: Samoa
- *Workshop for Disaster & Weather Personnel (December 20 08)*: Samoa

ATTACHMENT II – Training Summary

- *University Degree Training Meteorology (University of Queensland, Australia):* Solomon Islands
- *University Degree Training Climatology (University of the Pacific, Suva, Fiji):* Solomon Islands
- *University Degree Training in Information Technology (Victoria University, Wellington, New Zealand):* Solomon Islands
- *Observer Training:* Solomon Islands

Training Requirements

- *Post Graduate Course in Physics and Mathematics to facilitate student qualification to Meteorologist Courses:* Cook Islands
- *Forecaster Upgrades:*
 - *Weather Service Specialists to Forecaster:* FSM(2), Fiji, Samoa, Tonga
 - *Forecast Officer to Graduate Meteorologist:* FSM(2)
- *Courses to train:*
 - *Graduate Meteorologists:* Kiribati, PNG(3-5), Samoa, Vanuatu (2)
 - *Forecasters:* Kiribati (2-3),
 - *Weather Service Specialists/Observers:* Kiribati (2-3), Samoa
- *Oceanography, storm surge and swells:* FSM, Fiji, PNG, Solomon Is, Tonga
- *RANET & EMWIN training for technicians (Melbourne, Australia) :* FSM(2)
- *Radar/AWS maintenance training:* Fiji
- *Tropical Cyclone Analysis and Forecasting including DVORAK:* Fiji, New Caledonia, Tonga, Vanuatu
- *Trainers to visit countries and give presentations/lectures:* Indonesia
- *Attachment Training:* Indonesia
- *Climate Training:* Kiribati,
- *Satellite Interpretation:* New Caledonia
- *Using Forecasting Tools:* Niue
- *Research Attachment to Bureau of Meteorology or MetService New Zealand or NIWA:* PNG
- *Tropical Cyclone Module Training:* PNG
- *Aviation Meteorology Training:* Samoa, Solomon Islands, Tonga
- *Attachments to Technical Maintenance Centre(s):* PNG
- *NWP interpretation training:* Solomon Islands
- *Media Presentation Training:* Tonga

Appendix VI

Presentation on disaster risk reduction “brainstorming” session

(Available separately)