W O R L D M E T E O R O L O G I C A L O R G A N I Z A T I O N

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

THIRTEENTH SESSION

(BALI, INDONESIA, 26 to 29 APRIL 2010)

FINAL REPORT

GENERAL SUMMARY OF THE WORK OF THE SESSION

1. ORGANIZATION OF THE SESSION

1.1 Opening of the session

1.1.1 At the kind invitation of the Government of Indonesia, the thirteenth session of the WMO Regional Association V (South-West Pacific) Tropical Cyclone Committee for the South Pacific and South-East Indian Ocean (XIII-RA V/TCC) was held in Bali, Indonesia from 26 to 29 April 2010. The opening ceremony commenced at 0900 hours on Monday, 26 April 2010.

1.1.2 Mr Mike Bergin, Chairman of RA V/TCC, warmly welcomed delegates to the meeting and reminded them that the aim of the session was to further enhance the existing arrangements that seek to reduce the impacts of topical cyclones in the region. He reminded delegates of the recent events in Fiji with cyclone Tomas and in the Cook Island with cyclone Pat that saw quite devastating damage to houses and crops and the unfortunate deaths of several people. The significant sea level inundation associated with cyclone Tomas was a timely reminder of the serious consequences of those phenomena and further strengthened the determination of WMO to improve warning services for storm surge through the Storm Surge Watch Scheme. Mr Bergin urged members to work through the session to improve the delivery of tropical cyclone warning services through a review of the Operational Plan and to enhance the capacity to improve these services further through improvements to observing systems, the operationalisation of research and implementation of new forecasting systems delivered through the Technical Plan. Further Mr Bergin noted that an excellent adaptation strategy for potential increases in tropical cyclone impacts due to climate change, was a viable and credible warning system. He suggested that the meeting would also have to address implications of the new structural arrangements for WMO and RA V including the role the TCC would play in the development of a Strategic and Operational Plan for RA V. In closing, Mr Bergin thanked Meteorological, Climatological and Geophysical Agency (BMKG) for the very excellent facilities that had been provided for the meeting and for the extraordinary work of staff of BMKG over the preceding months to ensure the success of the TCC meeting.

1.1.3 Mr Arona Ngari, President of RA V and Permanent Representative of Cook Islands with WMO, welcomed the participants to the thirteenth session of RA V/TCC and expressed his appreciation to WMO and, through BMKG, the Government of Indonesia for hosting the session. As a blessed region, he urged the TCC to find means of ensuring that communities in this Region are well informed of the threats of cyclones that can have on the Region and find means of convincing respective governments of the importance of their work in providing an early warning system that can warn its communities and to save lives.

1.1.4 On behalf of Mr. Michel Jaraud, Secretary-General of WMO, Mr. Koji Kuroiwa, Chief, Tropical Cyclone Programme Division, Weather and Disaster Risk Reduction Services Department of WMO, welcomed the participants and expressed the sincere appreciation of WMO to the Government of Indonesia for hosting the thirteenth session of the Committee in Bali, Indonesia. He extended his particular gratitude to Ms Sri Woro B. Harijono, Director-General of BMKG for her earnest effort in the arrangements for this session. In referring to the Committee's commendable collaborative efforts of RSMC, TCWCs and NMHSs to strengthen their warning networks, Mr Kuroiwa encouraged the Committee Members to be constantly on the alert and further develop their synergies to strengthen its capacities and capabilities in warning and service delivery. He also emphasized that the Committee is expected to serve as an important platform for promoting the various regional projects, in particular the Severe Weather Forecasting and Disaster Risk Reduction Demonstration Project (SWFDDP) and Storm Surge Watch Scheme. In ensuring WMO's continued support for the Committee's programmes and activities, he wished the participants a very successful session and an enjoyable stay in Bali.

1.1.5 On behalf of Dr. Sri Woro B. Harijono, The Director General of BMKG, Mr. Tuwamin Mulyono, Deputy Director General for Meteorology, BMKG, welcomed the participants to the beautiful island of Bali, Indonesia, with an expression of being proud of hosting this meeting. He noted the variability of tropical cyclone development in terms of time and place. Tropical cyclone Kirrily that developed in low latitude is one of the proof of the variability. He also noted the needs of accurate and timely tropical cyclone warnings to reduce the socio-economic impact and therefore international cooperation for tropical cyclone warning services is indispensable. He informed the Committee of Indonesian contribution to the international cooperation for tropical cyclone warnings and briefed the Committee on the progress made by Indonesia. He officially opened the thirteeth session of the Committee and wished the Committee fruitful deliberations.

1.1.6 The session was attended by 34 participants, including 29 from RA V/TCC Member states and five regional and international organizations. The list of participants is given in **Appendix I**.

1.2 Adoption of the agenda

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

1.3 Election of vice-chairman

1.3.1 Mr Mulyono Rahadi Prabowo (Indonesia) was elected unanimously as vice-chairman of the thirteenth session of the Committee.

1.4 Working arrangements for the session

1.4.1 The Committee decided on its working hours and the arrangements for the session.

2. REPORT OF THE CHAIRMAN OF THE COMMITTEE

2.1 The Chairman presented the committee with his report on the main activities since the twelfth session of the Committee (Alofi, Niue, 11 to 17 July 2008)

2.2 The Chairman reported that over the past two tropical cyclone seasons we have again seen reduced numbers of tropical cyclones in the South-West Pacific Ocean east of 160E with only 6 cyclones in 2008/09 and a further 8 in season 2009/10. Consistent with an El Nino season we saw much of the activity focused in eastern parts during season 2009/10. In the area west of 160E there was slightly greater variability in activity between the past 2 seasons. In 2008/09 there were 10 cyclones but there were only 7 in the recent season. Two cyclones (Jasper, Ului) moved across the 160E boundary and are therefore included in both areas tallies. Across the RA V TCC area of responsibility there were 15 cyclones in 2008/09 and 14 in season 2009/10. Of interest is that 5 systems achieved category 4 or 5 intensity in season 2009/10 compared with only 2 in the previous season.

2.3 The Chairman reported on two significant cyclones that impacted the region through the past two years. Severe tropical cyclone Hamish formed in the northwest Coral Sea in March 2009 and quickly intensified into a category 4 and then category 5 cyclone and then tracked parallel to the Queensland coast over next the 4 days. While model guidance was fairly consistent for the continuation of that track there was much preparation for a possible recurvature westwards all along the Queensland east coast affecting many major regional centres. Evacuations were necessary from several offshore islands. A fishing trawler capsized off the Central Queensland coast as Hamish passed nearby. One of the 3 crew was rescued, but two remain missing. A bulk carrier just east of Brisbane, lost its cargo of containers in large waves, and leaking oil from its ruptured fuel tanks, left an oil slick on Southeast Queensland beaches from the Sunshine Coast to Bribie and Moreton Islands. Dangerous surf conditions also affected southeast Queensland beaches.

2.4 In March 2010 tropical cyclone Tomas made a significant impact on the Fiji group of islands. Tomas was the most intense tropical cyclone to affect Fiji since Cyclone Gavin in March of 1997. Tomas reached maximum intensity as a category four system with sustained winds estimated to be 100 knots and gusts to 140 knots.
Over 500 houses were destroyed and more than 1150 houses were damaged from hurricane force winds, damaging heavy swells and large storm surges associated with Tomas. Northern and eastern parts of the Fiji Group were devastated by Tomas, especially the agricultural sector and infrastructure, with damage estimates of $F83 million.

2.5 The Chairman noted the verification statistics from the past two seasons for the areas of responsibility for the Nadi RSMC and the Australian TCWCs was not complete due to the delay in preparation of best track data for several cyclones. He urged members to be diligent in the timely preparation of these assessments as robust verification is an important part of the improvement cycle for warning services. The Chairman also noted the lack of verification data at forecast times beyond 48 hours and urged members to prepare forecasts and complete verification for these longer term forecasts in order to provide earlier warning of the onset of tropical cyclones.

2.6 At the meeting in Niue in 2008 the TCC recommended the establishment of a Forecast Demonstration Project in the Southwest Pacific. That meeting made a number of recommendations about the possible scope and structure of the project emphasizing the importance of involving disaster mangers in the design and implementation of the project. The meeting also recommended the establishment of a Management Team and as a result of a considerable amount of work from members of the RSMT and staff at RSMC Wellington a Pilot Project commenced in late 2009 involving Fiji, Solomon Islands, Vanuatu and Samoa. Plans are well advanced to move to a full Demonstration Project for twelve months from November 2010, with the addition of Kiribati, Tuvalu, Tonga, Niue and Cook islands to the project

2.7 The Chairman also reported on the attendance of several experts from the region at the International Best Track Archive for Climate Stewardship (IBTrACS) Workshop – 5-7 May 2009. IBTrACS is an initiative of the World Data Centre in Asheville, North Carolina, USA and arose from a perceived need to gather in one place all of the disparate data sets of tropical cyclone activity from a variety of sources around the globe. Further the program seeks to encourage best and consistent practice in the future practice of best tracking tropical cyclone data.

2.8 The chairman expressed great concern over the loss of Ocean Surface Vector Wind (OSVW) data that was available for more than 10 years in the form of QuikScat. He specifically noted the significant degradation in our ability to determine the intensity of developing tropical cyclones and the size mature tropical cyclones, and reminded the Members that the massive expanses of the Southwest Pacific Ocean and the Southeast Indian Ocean requires the large special coverage provided by QuikScat. He noted that while some other OSVW data are available and are appreciated, they cannot provide the coverage, the accuracy, nor the mature tropical cyclone location and intensity techniques of the QuikScat. Finally, he noted that QuikScat is also vitally important for fine-tuning and assessing the quality and validity of the output of ocean wave and swell models.

2.9 The Chairman also reported on a number of training initiatives provided to staff from the region through the assistance of Australia, New Zealand, Japan, USA, France, Finland and WMO.

2.10 The Chairman reported on the ongoing difficulties of maintaining adequate numbers of Meteorologists at the RSMC Nadi despite several students attending the Bureau of Meteorology training program in the past 2 years. Further the issue of viable, quality meteorological services in the region has been a major focus of the Pacific Islands Forum Leaders who requested SPREP to undertake a review of these services and to provide the Forum with options for building on existing arrangements. That Review is now complete and will be used as a basis for further discussions at Pacific Forum meetings this year.

2.11 The Chairman reported on the outcomes of the Storm Surge Watch Scheme Action Team meeting held in Melbourne in December 2008 following a recommendation from the twelfth session of the TCC. As a result of that initiative there have already been several improvements in the provision of warnings of sea level inundation mainly delivered through the Severe Weather Forecasting and Disaster Risk Reduction Demonstration Project.

3. COORDINATION WITHIN THE WMO TROPICAL CYCLONE PROGRAMME

3.1 The Committee was informed by the WMO Secretariat that the Executive Council, at its 61st session in June 2009, gave following guidance to the Tropical Cyclone Programme (TCP):

- To give high priority to the organization of training workshops for the best use of ensemble-based products;
- To enhance the support measures for operational forecasters through update of the *Global Guide to Tropical Cyclone Forecasting* and development of the *Tropical Cyclone Forecaster's Websit*e.
- To promote the transfer from R&D to operational use through interactions between researchers and operational forecasters such the seventh International Workshop on Tropical Cyclones (IWTC-VII); La Reunion, 15-20 November 2010.
- To give high priority to development of the Storm Surge Watch Schemes with emphasis on capacity-building.

3.2 The Committee was pleased to note that TCP, in collaboration with World Weather Research Programme (WWRP) and Public Weather Services (PWS) Programme, has launched the "Typhoon Landfall Forecast Demonstration Project" on the initiative of the Shanghai Meteorological Bureau of China. This project was one of the major outcomes of the second International Workshop on Tropical Cyclone Landfall Processes (IWTCLP-II) held in Shanghai, China, in October 2009. It aims to demonstrate the performance of the most advanced forecasting techniques for landfalling typhoons and was expected to achieve development of techniques for evaluation & assessment of landfall forecasts, as well the forecast of landfalling typhoons including associated heavy rain.

3.3 The TCP/WWRP North Western Pacific Tropical Cyclones Ensemble Forecast Project was another outcome of WTCLP-II. The main objective of this project was to evaluate the effectiveness of the THORPEX Interactive Grand Global Ensemble (TIGGE) data to the operational tropical cyclone forecasting. TIGGE typhoon track data would be provided to the Typhoon Committee Members on a real-time basis via a password protected Web site which was expected to be established in May 2010. Training for operational forecasters and evaluation of the utility of such data in operational forecast were also planned to be conducted under the project. The project was targeted at the Typhoon Committee region in its first phase for 2010-2012 and would be extended to other regions in the future.

3.4 A series of International Workshop on Tropical Cyclones (IWTC) is also a major project jointly organized by TCP and WWRP for promoting collaboration between researchers and operational forecasters. The Committee was informed that the 7th Workshop (IWTC-VII) will be held in La Reunion, France from 15 to 20 November 2010 and WMO will fund three forecasters from RA V/TCC to participate in the Workshop.

3.5 Mr Chip Guard (US) informed the Committee of the update of the Global Guide to Tropical Cyclone Forecasting, which has been arranged by TCP at the initiative of Mr Guard as Chief Editor. He gave a progress report on the web-based version of the Global Guide to Tropical Cyclone Forecasting and provided an updated plan for completion of the Guide. The guide will be designed for forecasters and targeted, in particular, at those in developing countries and smaller RSMCs and TCWCs. It will also incorporate the content from applicable WMO publications and studies, especially in the areas of hydrology and disaster risk reduction. Despite several delays, there is a prestigious team of Chapter authors that

have completed or are in various stages of completing their Chapters. Structural and content reviews are ongoing, and technical and regional reviews will begin in the next month or so. The goal is to have the major part of the web-based version available for review and comment at the IWTC-VII to be held in La Réunion. Input from presentations at the IWTC-VII will also be incorporated and discussions on a printed version will begin at the workshop.

3.6 The Committee noted with satisfaction that SWFDDP was included in the programme of the 7th Southern Hemisphere Workshop on Public Weather Services held in Melbourne, Australia, from 10 to 14 September 2009. In view of the great relevance of the project to the tropical cyclone warning service in this region, the Committee urged WMO to keep the close link between TCP and DPFS Programmes towards an effective and successful implementation of SWFDDP.

3.7 The Committee was informed that the 6th TC RSMC/TCWC Technical Coordination Meeting (TCM-6) was held in Brisbane, Australia in November 2009, which covered a broad range of subjects to improve the coordination in operational and technical aspects of the tropical cyclone warning services across the basins. It took note in particular that the WMO Wind Averaging Study to provide a technical guideline for wind averaging conversion factors was completed and the final report was adopted. It noted with pleasure that the report will soon be published by TCP and its summary will be included in the operational plans/manual of the tropical cyclone regional bodies. TCP also plans to incorporate the report in a new version of the "Global Guide to Tropical Cyclone Forecasting" and the "Tropical Cyclone Forecasters' Website".

3.8 Concerning the improvement of advisories issued by Tropical Cyclone Advisory Centers (TCACs), which was also discussed at TCM-6, the representative of ICAO provided the Committee with a brief overview on TCACs and their role in international aviation. Implementation of tropical cyclone graphical advisories and changes to tropical cyclone SIGMET associated with Amendment 75 to Annex 3 applicable 18 November 2010 were presented to the session. Tropical cyclone graphical advisories will include the areas of gale force winds and frequent cumulonimbus (CB) at the request of the users. These advisories should be issued using Portable Network Graphic (PNG) format via the Internet. Moreover, Amendment 75 to Annex 3 aims to improve the clarity of SIGMET (which includes WC types) such as the use of "NN" for an unnamed cyclone and explicitly indicating the forecast time will be noted.

3.9 Another topic in the presentation includes coordination between WMO and ICAO with regards to harmonizing tropical cyclone information in SIGWX forecasts issued by World Area Forecast Centres (WAFCs) with tropical cyclone advisories issued by TCACs. This voluntary participation is through a chat room hosted by the WAFC Washington which is detailed in the WAFSOPSG/5 Decision 5/5.

3.10 Fiji requested ICAO assistance in facilitating bilateral agreements for services (e.g. TAF) provided to other States. ICAO offered the ability to provide draft bilateral agreements for interested States in the near term.

3.11 The session noted the value of the Severe Weather Information Centre and the information it provides on tropical cyclone warnings. The session was concerned that it does not have high recognition by Internet search engines and recommended that the site be tailored to ensure that it does have the high profile it deserves.

4. REVIEW OF THE 2008/2009 AND 2009/2010 CYCLONE SEASONS

Review by RSMC

4.1 The representative of the RSMC Nadi presented a comprehensive report on the 2008/2009 and the 2009/2010 tropical cyclone seasons.

4.2 In the 2008/2009 Tropical Cyclone season, tropical cyclone activity in the RSMC

Nadi area of responsibility (AOR) was well below average, under an initial warm neutral ENSO which became a cool La Nina in the middle of the season and then returned to warm neutral towards the end. Out of the 15 significant tropical disturbances monitored, only six attained tropical cyclone status; the sixth was named by Brisbane TCWC inside their AOR before moving into Nadi's AOR. Four of these cyclones attained storm intensity (category 2) while the remaining two were gales (category 1). Except for Lin, which directly affected Tonga, none of the cyclones caused any serious impacts to the Southwest Pacific communities. However, severe weather associated with a tropical depression did cause severe damage and 13 deaths in the Solomons.

4.3 Tropical cyclone activity during the 2009/2010 season was near average under a warm ENSO phase which gradually decayed towards the end of the season. A total of fifteen significant tropical disturbances were monitored, out of which, eight were named tropical cyclones. Five of these cyclones attained hurricane intensity (one category 5, three category 4 and one category 3), one storm (category 2) and two gales (category 1). The impact on the Southwest Pacific countries, especially Fiji , Cooks Islands , French Polynesia , Tonga and Wallis & Futuna, were severe with huge economic losses as well as casualties.

4.4 Some critical issues requiring urgent actions were raised including:

- the need for NMSs to upgrade their own synoptic observations network to required standards to support regional routine and severe weather forecasting needs;
- all ECMWF TC model runs to be made available in a format that can be easily used by TC Module as well as off the JTWC Collaboration site;
- urgent training workshops for forecasters on media skills; NMSs to engage in open dialogue as well as provide feedback to RSMC Nadi on operational matters during cyclone events;
- Capacity building in SIDS through short attachments of personnel or formal exchange of skills/tools between SIDS and our developed counterparts, and, WMO to release the TCOP before the beginning of the Southwest Pacific season to avoid operational discrepancies with national Directives.

4.5 The detailed report on the 2008/2009 and 2009/2010 cyclone seasons provided by the RSMC is given in **Appendix III**.

Review by Members

4.6 The representative of Australia informed the Committee that, in the season 2008/2009, there were ten tropical cyclones in the Australian area of responsibility, slightly above the 7 that occurred in season 2009/2010. Of the 10 cyclones in 2008/2009 only 2 became severe (greater than category 3 intensity). Both occurred in March 2009 with Hamish in the Coral Sea reaching category 5 intensity while Ilsa reached category 4 intensity in the Indian Ocean. Similarly in 2009/2010 only 2 cyclones became severe with Laurence in December 2009 just off the northwest Australian coast and Ului in March 2010 in the Coral Sea, 2010 both reaching category 5 intensity. Of all the cyclones in the Australian Region Hamish was the most threatening. Severe tropical cyclone Hamish formed in the northwest Coral Sea in March 2009 and quickly intensified into a category 4 and then category 5 cyclone and then tracked parallel to the Queensland coast over next the 4 days. While model guidance was fairly consistent for the continuation of that track there was much preparation for a possible recurvature westwards all along the Queensland east coast affecting many major regional centres. Hamish threatened to track near a number of offshore Islands, with associated damaging winds, large waves and elevated sea levels. Evacuations of the Whitsunday group of Islands, Heron, Lady Elliott and Fraser Island were organized prior to the potential impact of the system. Throughout the past 2 seasons the guidance provided by global NWP proved to be quite accurate. Final best track data for all cyclones have yet to be completed but indications from operational track data is that average errors at forecast times out to 72 hours have fallen slightly from previous seasons. Consensus track forecasting techniques continue to be employed across the Australian

Region. From the season 2008/2009, the cone of uncertainty areas are now set utilizing climatological errors at 24 and 48 hours. In the season 2008/2009 Australia adopted the same pressure/wind relationship across all TCWCs based on the work of Courtney et al and based on the work of Knaff and Zehr.

4.7 During the 2008/2009 and 2009/2010 seasons, no tropical cyclone developed in the area of responsibility of Jakarta TCWC. However, there were 13 suspect areas during the season. Five of them developed as a cyclone outside the region and others did not develope. It is noted that some cyclone around the country brought heavy rain over Indonesia through their rainband and wind patterns. Some of the samples of tropical cyclone related remote impact in Indonesia were reported. A special case occurred when Kirrily occurred in April 2009 near the equator in Banda Sea causing some minor damaged in Maluku. The representative of Indonesia reported that development had been made during 2008/2009 and 2009/2010, including the development of the backup system for Jakarta TCWC in Denpasar, Bali, additional AWS and radar network, installation of new forecaster workstations and development of the BMKG training centre.

4.8 In the Federated States of Micronesia (FSM), the State Governments deal with tropical cyclone (and multiple hazards) preparedness and response, while the National Government works collaboratively with the FSM State Government to address recovery and mitigation programs. Communications is the most difficult challenge in getting warnings out to the outer islands, and solutions to these communications problems are being actively pursued. Mudslides on the high islands and salt water intrusion on nearly all the islands are two major disasters often threatening the islands and impacting crops, residential areas, and the livelihood and safety of the people. High tides in 2008 devastated most of the low islands in the FSM damaging taro patches, destroying banana crops, and ruining the water resources in the islands. Yap and Chuuk states with many low islands suffered the most. Pohnpei has been hit hard with landslides, flooding, and flash floods. Kosrae has experienced problems with its coastal areas like most of the volcanic islands in the FSM. Due to limited resources in terms of funding and personnel capability, the FSM continues to seek more technical and financial supports from the world community through various agencies as the WMO, SPREP, and others.

4.9 The representative of Cook Islands informed the Committee that two cyclones passed close to the Cook Islands in the 2008-2009 season and five in the 2009-2010 season. It was TC PAT that affected the nation. TC PAT struck the island of Aitutak with an estimated damage of NZ$ 9.46 million mainly due to houses loosing roofs and some infrastructural damage to hospitals and electricity. The main damage from TC PAT of Category 3 was mainly from wind with strength of up to 100 knots. The automatic weather station in the island was destroyed.

4.10 The representative of Fiji informed the Committee that In the 2008/2009 Tropical Cyclone Season, Fiji was spared from any direct effects of tropical cyclone activity. Though Hettie and Lin developed close to the group, none posed any direct threat to the country, despite global models initially bringing the track over the country. However, the western parts of the largest island of Viti Levu experienced one of its worst floods in January 2009, not directly related to a cyclone that caused fatalities, devastated property, infrastructure and public utilities. Tropical cyclone activity during the 2009/10 Season for Fiji was above average with 2 named systems directly affecting the country. Mick (cat 2), tracked across the country from the Yasawas, over Viti Levu, thence the southern Lau group where it was downgraded to a depression before moving onto southern Tonga. Mick claimed 3 lives, and caused considerable damage that cost Fiji a total of $59.3 million Fiji dollars. In March 2010, severe Tropical Cyclone Tomas (cat 4) devastated the Northern and Eastern Divisions causing 2 fatalities and severe damage with a progressive cost of $83 million Fiji dollars as of April 24th 2010. Tomas's severe intensity and slow movement generated damaging heavy swells and waves which inundated and caused severe damages to most coastal areas and villages within a wide swath along its path. The RSMC Nadi received accolades from Fiji and abroad for providing the country with sufficient early warnings and advisories allowing all communities to prepare before the onset of gales.

4.11 Kiribati Meteorological Service (KMS) is a small government division within the Kiribati government and a non profitable organization that has difficulties ion its budget since 2008. Most of KMS plan activities were not feasible since government did not consider other divisional budget proposal within the last few years. Most of the improvements on KMS activities were earned through ongoing projects with KMS such as Upper Air program (WWW), Pacific Island Climate Prediction Program (PICPP), Island Climate Update (ICU) and other big regional projects. The key issues for KMS services are the ongoing needs of most of its outer islands station, insufficient number of staff to accommodate the increase in need of services to be delivered by KMS and lack of infrastructure such as weather forecasting equipments and other latest meteorological technologies that could improve the accuracy and reliability of the services. Actually, KMS haven't got any Forecasting section although there are number of staff already undergo NOAA forecasting training program. Due to the lack of instruments and lack of experience that could enhance this vital and required part of Meteorology product, weather forecasting were not yet started in Kiribati. There are so many severe weather events that already hit the Kiribati islands causing lot of damages, no warning information received by KMS or in other words unobserved by the KMS, this kind of situation raise lot of public concern and the distrust to KMS works by the general public including government. I do believe that having a forecasting section could clear all those concerns. However, KMS wishes to acknowledge the past support in terms of capacity building, equipments from projects who worked with KMS as we as WMO. We hope to have more support on the mentioned issues that we currently encounter and targeted more on reliable communication, luckily that Kiribati haven't experience Tropical Cyclones but we do feel it breaks when it too close to our region, Conversely, we had experienced lots of impacts from other low pressure systems adjacent to Kiribati. Tropical Cyclones positioning and development could be a question to Kiribati under Climate Change.

4.12 The representative of New Caledonia informed the Committee that the 2008/2009 cyclone season went on with neutral ENSO conditions. Little activity was recorded with only 2 phenomena in our warning area. The season lasted a mere 40 days with a late start in mid February and ended early in late March. Few cyclones were recorded overall in the SW Pacific. No systems were recorded for Wallis & Futuna. The 2009/2010 season starts with moderate El Nino conditions. Cyclonic activity is shifted easterly towards the centre of the Pacific. Cyclone Ului forms on Feb. 12th in northern Vanuatu off Santo and moves westerly along the north rim of our alert zone without threatening New Caledonia. The system moved westerly very slowly before taking a southerly and then south-westerly trajectory eventually to the Queensland coast. Cyclone Tomas forms north of Wallis Island and passes 100km west of Futuna Island (population is about 4000) on the 14th. Météo France's New Caledonia has jurisdiction over Wallis and Futuna and therefore provides model outputs, guidance and technical assistance to Wallis and Futuna weather service who in turn provided Civil Safety authorities with all necessary decision-making information. 24x7 shifts were activated in both Wallis and Nouméa offices. No casualties were reported but severe damage to coastal areas, crops (80% destroyed) and infrastructure occurred on Futuna. Most traditional "fales" were damaged or destroyed. Telephone lines were cut off for over 48 hours and we had no news of our 2 observers on Futuna during that time. Storm surge modelling for assessing damages in our report to Ministry level authorities in charge of relief funds is proving complex.

4.13 French Polynesia was affected by Oli from Feb 1st to 6th. Orange alert was decided as of the 2nd and red alert for Leeward Island and later on for the Windward Islands. The cyclone generated heavy rains and 6 to 8 m swells. Later on, Oli went on towards the Austral Islands hitting Tubuai on the 4th and 5th creating extensive damage to infrastructure and crops. One death and one severely wounded were reported. ECMWF tracks were remarkable during the whole lifecycle of Oli.

4.14 The representative of New Zealand informed the Committee that half of the eight tropical cyclones that formed in the Coral Sea and South Pacific area during the 2008-2009 crossed 25ºS into the Wellington area of responsibility. Only three of the ten tropical cyclones that formed in the Coral Sea and South Pacific area during the 2009-2010 season

crossed 25ºS into the Wellington area of responsibility. The high swell waves from tropical cyclone TOMAS damaged a derrick (crane) used for loading and unloading vessels at Raoul Island in the Kermandec group. RSMC Wellington backed up RSMC Nadi's TCWC function for 4 hours on 14 February 2010 as tropical cyclone RENE was moving southwest towards southern Tonga. The problem was related to a significant computer outage at RSMC Nadi. Between 12:00 UTC on 15-March and 00:00 UTC on 16-March 2010 RSMC Wellington and RSMC Nadi exchanged check bulletins as tropical cyclone TOMAS passed over eastern parts of Fiji and posed a threat Suva and, consequently, communications in and out Nadi.

4.15 The representative of Niue informed the Committee that Cyclone season 2008/2009 was quiet other than heavy rain from tropical LIN as it passed west-southwest of Niue. Cyclone season 2009/2010 was also quiet other than heavy rain from tropical cyclone NISHA as it passed to the northeast of Niue. Tropical cyclone RENE, RSMC Nadi issued a gale warning for Niue, again the island experienced heavy rain, windy conditions and rough seas. The public are kept informed on the above three systems both on the Radio and Television. Niue LRIT system was installed by Colin Schulz during the last week of January 2010. He conducted the training for all staff to farmiliarise themselves on how to operate the system and most importantly during a Cyclone season.

4.16 Papua New Guinea receives one Tropical Cyclone a year on average but the number varies seasonally. Some seasons has seen two (2) or three cyclones formed whilst others have literally none. Many of these Tropical Cyclones have formed in February during the peaking of NW winds over Papua New Guinea and the NW monsoon rains peak one month after the peak of the NW winds (see full report). The SE monsoon (SE Trades) peak in July and the dry season peaks two months after, in September. The two season, 2008/2009 and 2009/2010 have been quiet for Papua New Guinea, however, a huge TD which formed near Guam sent wave surges and raised seas by 20cm. Some land inundations occurred in the northern mainland PNG and the New Guinea Islands, no casualties were reported. During the peak of the SE Trade winds, several Gale warnings were issued and caused waves surges land inundations in Western and Gulf Provinces. These wave surges were further enhanced by spring/ king tides. In 2008-2010 number of installations took place; the LRIT system December 2009, Forecaster's workstations November 2009 and Port Moresby GUAN station restored in April 2010. Projects: Under EU administered by SPREP 5 AWSs, 2 High Resolution METEOSAT receivers are planned.

4.17 In the Samoa region, 2008-09 tropical cyclone season was fairly quiet as compared to the moderately active current 2009-10 where tropical cyclones Nisha, Oli, Pat, Rene, Sarah and Tomas were actively developed north of the country. Rene and Tomas were the only two (2) tropical cyclones that brought some moderately severe rainfall and strong winds to Upolu Island. The threat posed prompted the activation and operation of the National Tropical Cyclone Warning Centre (NTCWC). It is also worth to mention development of observations network during the period in support of tropical cyclone functions. That is, the JICA's AWS Extension and Grant-aid projects launched in 2005 and 2010 respectively to improve early warning systems. For upgrade of synoptic and climate stations now executed under the United Nations Framework Convention on Climate Change (UNFCCC) climate change fund project and Australia's Bureau of Meteorology. The calibration of instruments carried out by the New Zealand Meteorological Service Ltd. Finally, our on-going partnership is acknowledged with the US NOAA in the operation and maintenance of the additional six (6) automation stations.

4.18 The representative of Solomon Islands reported that the 2008/2009 cyclone season lapsed with no major cyclones occurring within the Solomon Islands. However, there are couple of low pressure systems that developed in the southern Solomon and the most notable one is the tropical depression is that occurred from the 28th January to 3rd February 2009. This depression caused severe flooding on most of the islands with big rivers and has resulted in 13 deaths on the Island of Guadalcanal and huge destruction to roads and bridges on Malaita and Guadalcanal. 2009/2010 cyclone season was very quiet in the early stages, late part of 2009 and things changed dramatically in early 2010. While recovery efforts were still ongoing on after an earthquake which generated a tsunami in the Western

Province 2010 on the 4th January 2010, a tropical depression (TD04) started in the southern parts of the country around 19th January and ended around 22nd January 2010 and caused severe flooding on the main islands. This flooding has resulted in two deaths (children) on Guadalcanal and damages to roads, bridges and agriculture in most of the big islands especially Malaita and Guadalcanal. In the month of March, from the 13th to 17th March 2010, there was cyclone Ului which affected the Southern parts of the Solomon Islands. Cyclone Ului was category 5 when it went south of Rennell and Bellona islands but apart from minor damages to homes and food gardens, there were no reports of deaths. It is also worth noting that most islands that were within the rain bands/Gale Force winds zone have reported considerable damages than Rennell and Bellona Islands which were the closest Islands to the cyclone centre.

4.19 The representative of Tonga informed the Committe that the Tonga Meteorological Service acknowlegded the support of the World Meteorological Organisation of the Tropical Cyclone Programme in the Region and reported on Tonga's experiences during the 2008/2009 and 2009/2010 tropical cyclone seasons. He highlighted the need for continued capacity building in the areas of media presentations, forcasting of storm surges and heavy rainfall associated with tropical cyclones and tropical depressions and making availability of tropical cyclone forecasting guidance material on emergency communication networks such as EMWIN and LRIT. Tonga also expressed the need for training support for maintenance of specialised equipment and tsunami monitoring and proposed that an on-line forecasters training programme similar to COMET be formulated for the Southern Hemisphere.

Ammendeds to South-West Pacific and South-East Indian Ocean Tropical Cyclone Operational Plan was proposed by Tonga included:

(1) the current definition of a tropical cyclone warning be changed to cater for fast developing tropical depressions near land that could become a tropical cyclone within 24hrs and
(2) for RSMC Wellington to consider dissemination of Special Weather Bulletins for the Pacific Islands through EMWIN in the event of failure or partial failure of RSMC Nadi

4.20 The 2008/2009 season for Vanuatu saw a total of 4 tropical depressions which either crossed Vanuatu and remained as a low pressure or passed through Vanuatu and then became a tropical cyclone. There were no damages caused by these tropical lows. During the 2009/2010 season, it was relatively quite for Vanuatu. The first and only cyclone to affect Vanuatu was TC Ului. TC Ului was a Category 1 cyclone as it remained close to the northern islands of Vanuatu. The damage was minimal, mostly to garden crops. On the development front, since the last TCC meeting, some notable developments have taken place. The Vanuatu Meteorological Service (VMS) continues to use TC module, providing a 48 hour forecast based on consensus, as well as the uncertainty area. All these products are made available on the website. Tropical cyclone forecasting has immensely improved, with 4 competent TC forecasters. VMS is also in the process of completing its 10 year strategic development plan, and was also part of the SWFDDP project.

4.21 The 2008/2009 tropical cyclone season for American Samoa was dominated by La Niña conditions and was very quiet. American Samoa was only remotely affected by two tropical depressions, and neither caused significant problems for the islands of American Samoa. By the middle of 2009, El Niño conditions developed, and an active tropical cyclone season was predicted for American Samoa. During the 2009/2010 season, four TCs, Nisha, Oli, Rene and Sarah formed near or passed closed to American Samoa. Only Cyclone Rene caused significant impacts to American Samoa, and that was primarily to the Manu'a Island Group. Rene was a strong Category 1 hurricane when it hit the Manu'a Island Group, and it caused extensive damage to agricultural vegetation, as well as major beach erosion and coastal flooding of low lying areas. Unfortunately, there was one indirect fatality. The highest winds recorded were 30 (1-min avg) G55 mph (1-min avg) at WSO Pago Pago and 43 (1-min avg) G82 mph from the Automated Weather Station on Ta'u Island. Two additional issues were discussed: (1) the September 29, 2010 earthquake and tsunami, and (2)

mudslide prediction. The forecast method and criteria for mudslide prediction across Micronesia was provided as was a PowerPoint presentation showing the mechanism of the mudslides.

4.22 In relation with the capacity building issues raised by the members under this agenda, the delegates of US informed the Committee of their training activities and relevant available materials. The US National Weather Service has long made available and free for use on line training modules COMET that were developed to meet the training needs of their own meteorological and hydrological professionals. These training modules cover subjects from basic level meteorology to climate change overviews and numerical weather prediction. There is currently over 700 hours of training online which anyone can use and receive certification of successful completion of the course. Tonga noted in their country report that they are using a series of the COMET modules as a part of a training program to certify their met service observers. Broader use of these modules by WMO member states is anticipated and US is engaged in working closely with the WMO training program to develop much needed standards and training material to meet new requirements for meteorological and hydrological professionals such as the ICAO Aviation Training requirements. Canada, Australia, Russia, Finland, and Spain have been working with NOAA and COMET to increase access and utility of these training modules.

4.23 The US VCP has recently sponsored the development of a Flash Flood Reference Guide that shall be published in the July 2010 and available on line as part of a series of reference guides on multi-hazard early warning systems. The first in the series was the Tsunami Warning System Reference Guide which give the end to end view of developing a tsunami warning system. There is material available on hurricane and typhoons for both forecasters and the general public. Hurricane Strikes is an award winning module designed for school children to learn about how to prepare for hurricanes. This module was widely distributed through the US and is currently being updated available in August on line. NOAA is also seeking donor support for development of Island Strikes that will help children on small islands prepare for hurricanes and typhoons. Teaching resources are available in association with these training measurs. Other measures are available on satellite applications for tropical forecasters. This year COMET will also update a module on Community H Prepardnesss which is common at emergency managers and decision makers. A new tropical meteorology text book will be available in the next year. In addition, many hydrology, emergency management resources, and media broadcast meteorology modules are available at the site; http://www.meted.ucar.edu/. The NOAA and COMET would work closely with the RAV Management Group on capacity building efforts leveraging these resources and assisting in making these training materials more broadly available and accessible to RAV.

4.24 Mr. Ed Young of NOAA delivered the Report from the RANET PACIFIC Communications Steering Committee. He reported that EMWIN (Emergency Managers Weather Information Network) is a no-cost wireless broadcast service from the NOAA geostationary satellites that allows Emergency Managers and Met Service Offices to get critical weather and certain other information directly from NWS in near real time. It utilizes low-cost satellite receiving systems and personal computer display. EMWIN disseminates information collected by Regional Telecommunications Hub (RTH) Washington and from the Internet, including geostationary satellite images from US and Japan.

4.25 The Committee noted the need to plan for transition of EMWIN receiving stations in the Pacific from GOES-11 to the replacement GOES-West satellite in the next 12-18 months and was pleased to note the funding has been secured by the US for hardware and software refreshes. The Committee encouraged countries within reach of the GOES-West EMWIN broadcast to provide the RANET Pacific Communications Steering Committee with products and data required, such as getting MTSAT images onto EMWIN, to support their NMHS operations, and data/information required for Pacific Island national disaster managers.

4.26 The Committee noted with satisfaction that the LRIT/WEFAX Replacement Project

funded by the US contribution to WMO VCP, is nearly completed and that it now includes a plan for a 2nd round of LRIT training sessions at receiving countries that will begin later in 2010. Other improvements in the system are underway to improve the broadcast, for example a RANET effort to separate the EMWIN data stream from the LRIT broadcast, which can address some of the need to have a backup method to get EMWIN data if the users' primary EMWIN system should fail.

4.27 The Committee noted the transition of RANET from a development communications platform to one that can sustain NMHS operations. The Committee was informed that funding was secured for the US NOAA GCOS/Met Service New Zealand Technical Support Centre in Wellington to provide technical support to the Pacific regional HF/RANET hub and the operational testing of active HF/RANET communication systems. A grant from USAID Office of Foreign Disaster Assistance was used to procure HF/RANET systems for Tonga, Tuvalu, and Kiribati, and the NOAA will address some of the needs for funding to expand support for additional HF/RANET systems.

4.28 Other RANET activities are being enhanced, such as the RANET SMS Text Message service for PTWC tsunami bulletins, establishment of FM radio stations in some Meteorological Offices in countries where 24-hour radio communications were not available, the work with the University of Hawaii PEACESAT and others to find solutions for a Pacific satellite broadcast to replace the RANET broadcast on the Worldspace Asia-Star satellite.

4.29 The reports on the 2008/2009 and 2009/2010 cyclone seasons provided by the members for the session are given in **Appendix IV**. PowerPoint presentations on the seasonal review will be posted on the WMO/TCP Website along with this final report.

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

5.1 Under this agenda item, the Committee designated Mr Alipate Waqaicelua (Fiji) to serve as rapporteur for updating the Operational Plan.

5.2 The Committee reviewed in depth the Operational Plan, taking into account changes and additions that emerged from this and the other agenda items.

5.3 The Committee made a number of amendments to the Operational Plan including:

a) The inclusion of the two different category systems used within the region to describe the intensity and characteristics of tropical cyclones. One is the Australian category system that is used by most countries in the Pacific and by RSMC Nadi. The second is the American Saffir-Simpson Tropical Cyclone scale that is used by American Samoa, by RSMC Honolulu and the US affiliated islands of the Western North Pacific Ocean.
b) The extension of the Jakarta TCWC Area of Responsibility eastwards to 141E combined with a slight adjustment on the southern boundary of that area.
c) The addition of the term cyclone tropical intense for Severe Tropical Cyclone which is used only in French Polynesia for cyclones with average wind speeds equal to or greater than 96 knots
d) The change of cyclone names; in the Australian List the names Hamish, Magda and Laurence were retired and replaced by Herman, Megan and Lincoln, respectively. The name Catherine was also added to the Australian list to replace Cathy which was withdrawn during the 2008/09 season. In the RSMC Nadi list the names Tomas, Ului, Mick, Oli and Pat were retired and were replaced with Tasi, Ola, Mia and Pili respectively.
e) Inclusion of 3-Day TC Outlook issued by RSMC Nadi for the duration of the cyclone season and at other times as necessary.
f) Inclusion of TC Advisory for Aviation issued by TCAC Nadi for tropical cyclones occurring in its area of responsibility.

5.4 There were also a number of minor changes made to provide clarity or to correct format, spelling or grammatical errors.

5.5 The Committee requested the WMO Secretariat to publish a new edition of the Tropical Cyclone Operational Plan in both English and French as a WMO Technical Document (WMO/TD-No. 292) in the TCP series (Report No. TCP 24) before the start of the 2010/2011 tropical cyclone season.

6 REVIEW OF THE COMMITTEE TECHNICAL PLAN AND IMPLEMENTATION PROGRAMME FOR THE PERIOD 2010 – 2014 (Agenda item 6)

6.1 Under this agenda item, the Committee designated Mr Steve Ready (New Zealand) as rapporteur to assist the Committee to review the current Technical Plan and to formulate the new plan for the period 2010-2014.

6.2 The Committee agreed to retain the "essential" rated items from the current Technical Plan, delete completed or other items that had gained no traction and consign the remainder to a separate Table (**Appendix VI**) entitled *"RA V Tropical Cyclone Committee's Activities for Possible Future Action".* The revised Technical Plan has been grouped into five areas - Provision of Training & Capacity Building, Communications & IT Upgrade, Observation Networks Upgrade, Forecasts & Warnings Capability Upgrade and Promote Applied Research.

6.3 The layout of the updated Technical Plan was streamlined to retain fewer columns. The revised Table includes just four columns - Activities (previously known as Elements), Strategies, Key Stakeholders and Key Performance Indicators (previously known as Performance Target). For the time being, the columns for Rating, Potential resources, Focal Point, Progress and Remarks have been deleted but may be reconsidered in the formulation of the first Technical Plan under the new WMO RA V Strategic structure.

6.4 The Committee recommended that a Sub-Committee of the RA V TCC be given the resources to revise the new Technical Plan within 12 months of the 13th Session to ensure it is consistent with the new RA V Structure and Strategic Plan. The forthcoming SWFDDP meeting in New Zealand was seen as a possible opportunity to complete this work.

6.5 The Committee's 2010-2014 Technical Plan is given in **Appendix V**.

7. STORM SURGE ADVISORY ARRANGEMENTS (Agenda Item 7)

7.1 The Committee recalled that, at its twelfth session (Niue, July 2008), it decided to form an Action Team to examine the current status of storm surge warning services in the Region and to provide recommendations for implementing a Storm Surge Watch Scheme (SSWS) in Region V, in response to the request by the WMO Executive Council (EC-LX; June 2008).

7.2 The Committee noted with satisfaction that the Action Team held its first meeting in Melbourne, Australia, from 15 to 16 December 2008 following the fifth TCP/JCOMM Regional Workshop on Storm Surge and Wave Forecasting (Melbourne; 1-5 December 2008).

7.3 The Action Team recommended that storm surge information associated with tropical cyclones be formally incorporated into all tropical cyclone-related bulletins issued by RSMCs in RA V. However, the Action Team noted that sea water inundation could arise from three distinct mechanisms:

- Storm surges associated with tropical cyclones
- Large waves associated with tropical cyclones
- Long-period waves (remotely generated swell).

It identified a number of actions, flowing from their recommendations, that would need further follow up work.

7.4 The Committee reviewed these action items and noted the progress reported by the Secretariat. The meeting noted that marine aspects would now be included in the SWFDDP through which long period swell guidance products from ECMWF would be available. Some action items from the SSWS Action Team meeting were still listed as ongoing. However there were some actions listed as completed that still required further action. Although the threshold for Nadi warnings had been reduced from 4 to 3 metres, the action item on determining appropriate period and height thresholds had not been completed, and there had been no action on bilateral agreements.

7.5 The Committee was also advised of progress in developing SSWS in other regions, including:

- Commencement in 2009 of an advisory service by RSMC New Delhi using a high resolution storm surge model developed by the Indian Institute of Technology and the use of that model in other countries such as Myanmar for domestic storm surge warnings
- Plans for RSMC Tokyo to commence dissemination of storm surge charts in 2011 and time series point values in 2012
- Commencement of probabilistic forecasts in 2009 by NHC (Miami) using the SLOSH model (for the US only at this stage)
- Commencement of the Coastal Inundation Forecast Demonstration Project (CIFDP).

7.6 The Committee discussed problems of applying storm surge models to the Pacific region such as the vast number of small islands and the inadequate bathymetry data. The Committee also felt that there was already a high level of public awareness of the dangers of sea water inundation associated with tropical cyclones. However, the Committee noted that there was less public understanding of the nature of inundation caused by remotely generated long period swells.

7.7 The Committee was of the view that more should be done to improve services to the public across the three types of inundation identified by the previous session. This may be through refining empirical approaches, but the Committee also felt that it was worthwhile to investigate the potential of storm surge models. The Committee also noted that inundation could arise from tropical depressions and attention should be given to these. Training in ocean wave forecasting was also identified as a significant need. The Committee made the following recommendations:

Recommendations:

A) Noting

- *The request by Executive Council to develop regional storm surge watch schemes,*
- *The variety of mechanisms for sea water inundation requiring different approaches,*
- *the significant impact in some countries from remotely generated swells,*
- *the deliberations and action arising from the SSWS Action Team, and*
- *the particular characteristic of the TCC region with its many small islands.*

the following recommendations are made to address the three different, although not entirely independent, types of sea water inundation:

1. Storm surge associated with TCs

- *Resources be made available to develop guidance material and look-up tables for*

small islands based on character of surrounding reefs with the aim of translating qualitative deep sea estimates into more detailed forecasts,

- *Resources be made available to consider the applicability of modeling solutions (such as those at JMA or IIT) to the Pacific with a view to installation in RSMC Nadi and potentially other NMHSs for guidance in high priority sensitive locations in the region,*
- *If a storm modeling approach is found to have application, resources should be provided to implement that capability,*
- *Training opportunities be provided.*

2. Inundation from wind wave and swell associated with TCs and tropical depressions

- *Resources be made available to develop guidelines and look-up tables for small islands to account in general terms for the effect of the type of surrounding reefs with the aim of translating qualitative deep sea estimates into more detailed local forecasts,*
- *Training opportunities be provided.*

3. Long period remotely generated swell:

Noting that good guidance for this phenomenon is available through new NWP wave models (such as the ECMWF) capable of identifying the contribution of waves of different periods and that such products are available through SWFDDP, that:

- *A program of training for forecasters be provided,*
- *public education resources be developed for use by NMHS in community awareness campaigns,*
- *NWP products with information on the wave components at a range of periods be made available to NMHSs and,*
- *That the profile and enhanced services already developed for this phenomenon through the SWFDDP be maintained through,*
- *Resources being provided for a regional centre to provide ongoing assistance in the interpretation of model output through synthesized guidance products to smaller NMHS,*
- *Assistance to NMHSs in maintaining a focus on public education and community awareness and to translate the guidance products into advisory and alerting services for the community,*
- *Ongoing support for a central web site such as MetConnect.*

B) The committee agreed to form a Task Team to oversee the effective and prompt implementation of these recommendations. The committee further agreed that the Task Team should comprise:

- *A representative from the SWFDDP Management Team (Chair),*
- *A representative from RSMC Nadi,*
- *A representative from the NHM of a Member country,*
- *A technical expert from either CAWCR or NIWA,*
- *A representative from the Emergency Management Service of a Member country.*

8. ASSISTANCE REQUIRED FOR THE IMPLEMENTATION OF THE PROGRAMME FOR FUTURE DEVELOPMENT

8.1 Assistance required for the Implementation of the Programme for Future Development

8.1.1 The Committee noted the information on the progress of assistance provided to Members of RA V for the further development of weather, climate and water services, including tropical cyclone warning services. It expressed its appreciation to the Secretary-

General, Members and development partners for their continuous support.

Regional Office for Asia and South-West Pacific and WMO Office for the South-West Pacific (Apia)

8.1.2 The Committee noted the that the Regional Office for Asia and the South-West Pacific and the WMO Office for the South-West Pacific in Apia (Samoa) operate as an integral part of WMO Secretariat and in close collaboration with WMO technical and scientific departments and Members; (i) to provide support to the president and vice-president of RA V, Working Groups and rapporteurs, and to follow up matters pertaining to the Association on behalf of the president; (ii) to provide technical assistance and advice to concerned Members of RA V in developing and implementing technical cooperation projects and regional development strategy, including the Strategic Plan for the Enhancement of National Meteorological and Hydrological Services in RA V, the development of national strategic plans for Kiribati and Vanuatu Meteorological Services, and the implementation of the Pacific SIDS LRIT project; (iii) collaboration with UN system in Apia, Port Moresby and Suva and regional organizations such as the Association of Southeast Asian Nations (ASEAN) Sub-Committee on Meteorology and Geophysics (SCMG), the Asian Disaster Preparedness Centre (ADPC), the Secretariat of the Pacific Environment Programme (SPREP), the Secretariat of the Pacific Applied Geoscience Commission (SOPAC) and the Pacific islands Forum Secretariat (PIFS).

Regional and Subregional Events

8.1.3 The Committee also noted the information on regional events organized by WMO and its Members, and regional partners. The events include: (i) the fifth Technical Conference on Management of Meteorological and Hydrological Services in RA V (South-West Pacific), Kuala Lumpur, Malaysia, 20–24 April 2009; (ii) the WMO Regional Seminar on Enhancing Service Delivery by NMHSs in RA V (South-West Pacific), Kuala Lumpur, Malaysia, 2-6 April 2007; (iii) the International Training Course on Marine Meteorology for the South Pacific NMSs (co-organized with Météo-France), Tahiti, French Polynesia, 8-12 October 2007; (iv) the Regional Training Course in Aviation Meteorology for the Pacific Islands NMSs (co-organized with Météo-France), Noumea, New Caledonia, 20-24 October 2008; (v)th the training Workshop on Severe Weather Situations for Forecasters from Pacific Islands NMSs (co-organized with Météo-France), Tahiti, French Polynesia, 13-21 October 2009; (vi) the Training on Operational Tropical Cyclone Forecasting at RSMC Nadi-TCC, Nadi, Fiji, 3-13 December 2007 and 24 November-4 December 2009; (vii) the thirteenth RMSD (co-organized with SPREP), Nadi, Fiji, 5-8 May 2009; (viii) the Joint Pacific Regional Meeting of NMSs Directors and NDMO Managers (co-organized with SPREP and SOPAC), Nadi, Fiji, 11 May 2009; and (ix) the Pacific International Desk Training Programme at RSMC Honolulu, NOAA/NWS, Hawaii, USA, Honolulu.

Experts Missions to Members

8.1.4 The Committee was informed that experts missions were carried out to other Members, including: (i) a fact finding mission to Timor-Leste in February 2007 to assist in assessing the basic meteorological infrastructure and to make recommendations for the establishment of the National Meteorological Service and the setting up of a Meteorological Emergency Management Office; (ii) an expert mission to Marshall Islands and Palau in July 2009 to have discussions with relevant authorities on the development of meteorology and hydrology and memberships with WMO; (iii) a consultancy expert mission to Vanuatu in December 2009 to assist the Vanuatu Meteorological Service to review its strategic plan; and (iv) a consultancy expert mission to Kiribati in February 2010 to assist Kiribati Meteorological Service to develop its strategic plan.

Technical Cooperation Projects

8.1.5 The Committee was also informed of WMO, in collaboration with SOPAC assisted

the small islands in the Region in the development and implementation of the Pacific-HYCOS project. The project is designed to address five priority areas as identified by RA V-WGH, including: flood forecasting and warning; water resources assessment in major rivers; drought monitoring; groundwater monitoring and assessment; water quality monitoring and assessment and data management. It was originally conceived for 5 years, but European Union (EU) funding is only available for 3 years. The need of a WHYCOS project for South-East Asia was considered by members of RA V Working Group on Hydrology (RA V-WGH) during their fifth and sixth sessions in 2005 and 2007. During the seventh session, Indonesia, Malaysia and the Philippines expressed interest in participating in advancing the WHYCOS programme in Southeast Asia, referred to as the South-East Asian HYCOS (SEA-HYCOS). In response to this initiative, WMO is considering assisting the countries in the Region to develop a SEA-HYCOS project.

8.1.6 The Committee noted that WMO has collaborated with SPREP and the "Finnish-Pacific Project for Increased Capacity of SPREP and PIC NMS Staff to Meet the Growing Demand for Meteorological and Climatological Information in the Society" project.

Voluntary Cooperation Programme (VCP)

8.1.7 The Committed was informed of the progress of VCP projects in Region V. These included: (i) the regional VCP coordinated project, financially supported by the USA, for the provision of LRUSs to enable SIDS in the Pacific to have access to meteorological satellite images in LRIT format, is successfully implemented; (ii) Kiribati - surface observing instruments were provided by Australia for the restoration of surface observing network; (iii) Philippines - restoration of the Global Telecommunication System (GTS) message switching system in the National Meteorological Centre (NMC) was completed with the support of Japan in 2007, and an expert services for capacity building on the use of remotely-sensed radar and weather satellite data is underway; (iv) VCP requests for upgrading the Internet access facilities were received from Kiribati, Solomon Islands and Vanuatu, and plans are underway for these to be implemented with the VCP (F);and (v) Outstanding VCP project requests remain from - Philippines for upper-air consumables and upgrading of the WMO Regional Instrument Centre (RIC), Solomon Islands for the improvement of meteorological telecommunications and establishment of a new upper-air station, and Niue for the development of meteorology legislation and policy.

Emergency Assistance Fund Scheme

8.1.8 The Committee was informed that under the framework of the WMO Emergency Assistance Fund scheme, plans are underway to provide support to restore basic WWW facilities for Samoa and Tonga affected during the tsunami in September 2009. The USA has provided some assistance in collaboration with New Zealand to assist Tonga in its recovery and re-establishment of meteorological services. Assistance has been requested by the Cook Islands following tropical cyclone Pat. While the Committee acknowledged the value and importance of members have been affected by a disaster that directly affects NMHSs operations to quickly assess these impacts even these are only able to provide ballpark estimates, and report it quickly to the WMO Office for the South-West Pacific, while at the same time compiling more detail impact assessment required to comply with more formal reporting requirements to receive emergency assistance from WMO and donors. This may place burden on NMHSs staff during difficult times when their countries are heavily involved in recovery and response phases of disasters. However, this parallel of reporting of impacts and assessments provide invaluable information that some donors to quickly target emergency assistance to help NMHSs quickly recover and restore critical operational capabilities.

Assistance to Least Developed Countries (LDCs)

8.1.9 The Committee noted consultancy expert missions were carried out to (i) Kiribati, led by Mr P. Lefale (MetService New Zealand) in February 2010 to assist the Kiribati National

Meteorological Service to develop its Strategic Plan; and a plan is underway for training of weather observers in mid-2010; and (ii) Vanuatu, led by Mr M. Bergin (Australian Bureau of Meteorology) in December 2009 to assist the Vanuatu Meteorological Service to review its strategic plan; a plan is underway for training of weather observers in late-2010. With respect to the Solomon Islands, discussion is underway support training and development the Meteorological Service's weather and tropical cyclone forecasting division.

Website on Regional Activities

8.1.10 The Committee was informed that the Regional Office for Asia and South-West Pacific has established the Website on Regional Activities for Asia and the South-West Pacific (http://www.wmo.ch/pages/prog/rp/RAP_en.html) which includes information and news on events of regional interest. This Website also serves to establish a closer relationship between the Offices and the Members of RA II and RA V.

Education, Training and Human Capacity Development

Fellowships

8.1.11 The Committee was informed that In 2009, Ms Morah Yerta (Vanuatu) and Mr Sanjay Prakash (Fiji) completed the graduate diploma in meteorology at the Australian Bureau of Meteorology Training Centre (BMTC); and Ms Aditi Y. Sharan (Fiji), Mr R. R. Prasad (Fiji) and Mr L. Tauvale (Samoa) are studying the course in 2010. Mr Ueneta Torua (Kiribati) and Mr Tom Natik Harris (Vanuatu) fellowships are pending upon acceptance and admission at the University of the Philippines. And Ms. Elinor Lutu-McMoore from America Samoa completed a B.S. in meteorology at the university of Hawaii (May 2010).

8.1.12 The session noted that many training initiatives had been conducted since the last session and noted the increase in capability among staff in the region. The session noted, however, that there did not appear to be a single comprehensive list. The session was concerned that the training could be uncoordinated, and also that evaluation was not routinely conducted to assess the value of training delivered and to guide future development of training.

The session recommended that evaluation be a routine component of any training. The session also recommended that a consolidated database of training and summaries of evaluation be maintained at the regional office for RA V.

The Committee noted the value of on-line training modules on tropical cyclones developed under COMET. The Committee recommended that resources be allocated to develop COMET like southern hemisphere versions of these training modules.

8.1.13 Previous sessions of the TCC and other meetings in RA V had highlighted that media presentations were an effective way of improving the visibility of NMHSs and that there was an increasing demand for NMHS staff to appear in media interview during severe weather events. Several NMHS noted that they needed both media training and resources such as presentation software and advice on developing opportunities with the media. The session recommends that training and resources be addressed under activities of the WMO Public Weather Services Programme in coordination with the VCP.

8.2 Regional Strategic Planning and Future Working Mechanism of the Association

8.2.1 The Committee recalled that the fourteenth session of RA V (Adelaide, Australia, May 2006) had agreed on the priority areas of concern for Region V and decided to develop a Strategic Plan for the Enhancement of NMHSs in RA V that focuses on the specific needs and requirements within the Region.

8.2.2 The Committee was provided with information on the progress on the development of the RA V Strategic Plan. The Committee noted with appreciation that a draft Strategic Plan for the Enhancement of NMHSs in RA V (2010-2011) was developed by the Task Team on Strategic Planning, established by the fourteenth session of the Association, and in consultation with Members and with guidance by the Management Group. The draft Strategic Plan has taken into account the Strategic Goals identified in the 2007 RA V Regional Seminar (Kuala Lumpur, April 2007), the WMO Strategic Plan (WMO-No. 1028), the WMO Secretariat Operating Plan 2008-2011 (WMO/TD-No. 1417), and suggestions from Members of the Region. A set of deliverables identified by the Task Team were further streamlined through the discussions and survey on high-priority, realistic and achievable deliverables during the Fifth Technical Conference on Management of Meteorological and Hydrological Services in RA V (Kuala Lumpur, April 2009). These 87 deliverables are action-oriented and categorized under 35 Regional Expected Results in accordance with WMO's set of Expected Results.

8.2.3 The Committee was informed that the Task Team for Strategic Planning also initiated development of the RA V Strategic Operating Plan for 2012-2015, by mapping the deliverables under Regional Expected Results identified in the RA V Strategic Plan 2010-2011 into the new five Strategic Thrusts and eight Expected Results of the draft WMO Strategic Plan 2012-2015. It further noted the proposed roadmap towards development, refinement and endorsement of a new RA V Strategic Operating Plan (SOP) for 2012-2015.

8.2.4 In this connection, the Committee was informed of the initiatives undertaken by other Regional Associations (RA II, RA IV and RA VI) to develop a more efficient working mechanism within the Association, including the composition of subsidiary bodies, to implement the regional Strategic Plans. It also noted that the future working mechanism of the Association was discussed during the recent Working Group sessions, including WG on Planning and Implementation of the WWW (WG-PIW: Honolulu, 7-10 December 2009); WG on Hydrology (WGH: Bandung, 14-18 December 2009); and WG on Climate-related Matters (WG-CRM: Nadi, 8-11 February 2010). In particular, WG-PIW strongly recommended that an equivalent of the Tropical Cyclone Committee for the Pacific and South-East Indian Ocean should continue in a standing role. Noting that the TCC has proved successful in improving tropical cyclone services, WG-PIW suggested that the scope of the TCC could be expanded to include other aspects of early warnings such as the warnings components for tsunamis.

8.2.5 In this regard, a proposal for the future work structure of RA V by the Management Group was introduced to the Committee. The Committee noted that the establishment of a Task Team on Storm Surge is proposed within the new Tropical Cyclone Committee, and a Task Team on Disaster Risk Reduction/Public Weather Services including SWFDDP is proposed within the new Working Group on Services Development. The Committee agreed to make a recommendation to the XV-RA V session on the re-establishment of the Tropical Cyclone Committee with two Task Teams on Storm Surge and SWFDDP, with the draft Terms of Reference of the Committee, as given in **Appendix VII**.

9. OTHER BUSINESS (Agenda item 8)

9.1 Severe Weather Forecasting Disaster Risk Reduction Demonstration Project (Agenda item 8.1)

9.1.1 Mr Steve Ready (New Zealand), Chairman of the Regional Sub-project Management Team, presented a progress report on the Severe Weather and Disaster Risk Reduction Demonstration Project (SWFDDP). His report covered aspects such as the establishment of the MetConnect Pacific web-site, the provision of guidance NWP products from global and regional centres, the in-country training program, the daily guidance provided from RSMC Wellington and the services provided by the participating countries since the commencement of the pilot phase in November 2009. The report also outlined the plans for the demonstration phase and the additional countries that will be included in that phase.

9.1.2 The Committee commended Steve Ready, his team and all the contributors (both individuals and meteorological services) on the great work undertaken and the significant achievements already realized. The Committee strongly endorsed the plans for the project and looked forward to a transition to operational status and extension to other areas of RA V.

9.1.3 The participating countries reported on the valuable information available through MetConnect Pacific and the benefits of the project so far in building forecasting capability and improved early warnings of severe weather, and in improving the profile of the NMHS in the community and with NDMOs.

9.1.4 Mr Ready's report highlighted the problem of the high number of marginal weather events on current guidance charts. The Committee agreed that the thresholds for rainfall and wave height be reviewed before the demonstration phase although this should not diminish the guidance on remotely generated long period swell.

9.1.5 Regarding future plans, several countries expressed interest in a westwards extension of the domain.

9.1.6 The US representative advised that funding had been obtained to have NCEP products included on MetConnect Pacific.

9.1.7 There was some concern that the Disaster Risk Reduction component of the project did not appear to be well-developed. Success of the SWFDDP would only be demonstrated through end-to-end impact from translating new products into new services for the public in the participating countries. The Committee noted that the project is in its early stages and the first progress reports are only now being prepared. However, the Committee stressed that the Public Weather Service (PWS) and DRR components needed a strong focus.

9.1.8 The Chair of the Committee recalled that at the previous TCC meeting in Niue, there had been a proposal for two distinct projects in RA V – a Severe Weather Forecasting Demonstration Project initiated under the Data-processing and Forecast System program, and a separate DRR project. The Committee had decided that it would be more effective to have a single project that demonstrated end-to-end transition of scientific capability through to use by the community and emergency service sector. The WMO Secretariat had advised that there was an allocation of funds for a DRR project and that these funds could be used for the combined SWFDDP.

9.1.9 The Committee noted that funding for the SWFDDP was limited and expressed disappointment that the expected DRR funds had not materialized. The Committee requested that DRR funds be made available to assist the development of the DRR and PWS components. The Committee also requested that the DRR and PWS components be a well-resourced element of the training for the project.

9.1.10 The Committee noted that the Vigilance system developed by MeteoFrance and used in New Caledonia is a system worth considering to make the "last mile" connection to the community. The Vigilance system is multi-hazard and presents a risk forecast rather than simply a weather forecast. The Committee noted that adoption of Vigilance or a similar system may be an appropriate means of linking the scientific capabilities of the SWFDDP into the DRR sphere.

9.1.11 The Committee noted that good Internet bandwidth was necessary for satisfactory access to the wealth of products available through MetConnect Pacific. The Committee recognized that many small island states in the Pacific had limited or unreliable Internet access. The Committee recommended that high priority and urgency be given to the initiatives being considered to develop a pan-Pacific satellite broadcast capability that may be used to improve access to MetConnect products.

9.1.12 The Committee noted that continuation of the Regional Sub-project Management Team (RSMT) was vital to the success of the SWFDDP and requested that resources be

allocated by the Secretariat, in collaboration with donor partners, to ensure that the Project can continue.

9.1.13 The Committee also considered the possible location of the RSMT within the new organizational structure of RA V. The Committee noted that the RSMT fits the characteristic of a Task Team as a short-term task-focused group. Noting that:

- both tropical cyclones and other types of meteorological and marine hazards are being dealt with under the TCC
- the composition of the TCC brings all relevant participants together the Committee recommended that the RSMT should be established as a Task Team under the TCC (assuming that the TCC continues as is expected).

9.2 Support to Fiji (Agenda item 8.2)

9.2.1 The Committee noted the progress of assistance to Fiji/RSMC Nadi which the Secretariat has directly and/or closely involved in with Members and regional organizations such as SPREP and SOPAC since its twelfth session held in Niue, in July 2008. The assistance included seven fellowships during the period of 2009-2010 (2 supported by WMO, 3 supported by the Government of Fiji and 1 supported by the Australian Bureau of Meteorology); two staff from RSMC Nadi also participated in two regional meteorological training events co-organized by Mètèo France and the Secretariat during the period of 2008-2009; Fiji/RSMC Nadi is also a reciepient of ground-receiving equipment to access meteorological satellite images in LRIT format under a "WMO VCP Regional Coordinated Project for Pacific SIDS"; and Fiji/RSMC Nadi participation in the Pacific-HYCOS and the "Finnish-Pacific Project for Increased Capacity of SPREP and PIC NMS Staff to Meet the Growing Demand for Meteorological and Climatological Information in the Society" projects.

9.2.2 While the Committee acknowledged these efforts and the progress report on assistance to Fiji/RSMC Nadi, it also recognized that more yet to be done. The Committee emphasized that: recommendations emanating from its twelfth session to continue to be pursued including: to urge members to assisting RSMC Nadi through the continuation of training and capacity building opportunities and where possible the secondment of suitable staff, and to request the Secretary-General to organize a high level dialogue on RSMC Nadi. Furthermore, given that assistance to Fiji/RSMC Nadi are from various sources, the Committee also requested that all relevant information on assistance to Fiji/RSMC Nadi from the Secretariat, Members and development partners to be included in future reports/documents of the Committee's sessions.

9.2.3 The Committee also noted the request from Fiji/RSMC Nadi including: three fellowships per year; and for the Australian Bureau of Meteorology to continue providing a tropical cyclone expert for a period of six month per year, training, update and technical support for the Tropical Cyclone Module, Fiji Integrated Meteorological System (FIMS) and radar. It recommended to WMO and its Members, and development partners to provide the needed assistance to Fiji/RSMC Nadi to address these requests.

9.3 Review of meteorological services in the Pacific region called for by the PIF (Pacific Islands Forum) Leaders

9.3.1 Representative of the Secretariat of the Pacific Regional Environment Programme (SPREP) made a presentation on the progress of the review of Pacific Regional Meteorological Services as commissioned by SPREP in November 2009.

9.3.2 The Review on Regional Meteorological Services commissioned by the Pacific Forum Leaders to SPREP in their 2008 meeting has recently come to conclusion in April 2010. The Review report has been officially released by SPREP and has been circulated to SPREP Members, members of the Regional Meteorological Services Directors, and the Policy Oversight Group of the Review. In summary, the report outlines 10 recommendations,

divided into 3 groupings identified as; (i) regional coordination and support (ii) strengthening national meteorological services (iii) regional specialized meteorological services. The presentation of these outlined the recommendations and provided brief coverage of the rationale of the recommendations, while also outlining the next key steps in as far as the progress of the report findings towards the meeting of the Pacific Forum Leaders planned for August 2010. Fuller discussion and collection of views on the Review shall be undertaken in more depth at the mini-RMSD organised in the margins of the WMO RA V session.

10. DATE AND PLACE OF THE FOURTEENTH SESSION (Agenda item 9*)*

10.1 The delegate of Samoa informed the Committee that his country is willing to host the fourteenth session of the RA V/TCC in 2012. The Committee welcomed the offer and requested the Secretary-General of WMO to take an appropriate action, in consultation with the president of RA V and the Chairman of the Committee, to make necessary arrangements for the next session.

11. CLOSURE OF THE SESSION (Agenda item 10)

11.1 The report of the thirteenth session of the Committee was adopted at its final meeting on 29 April 2010 at hours.

LIST OF APPENDICES

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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 (2008/2009 and 2009/2010)

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

7. Storm Surge Advisory Arrangements

8. Assistance required for the implementation of the programme for the development of services

9. Other business

    (i) Review of meteorological services in the Pacific region called for by the PIF Leaders.
    (ii) Severe Weather Forecast and Disaster Risk Reduction Demonstration Project
    (iii) Support to RSMC Nadi

10. Date and place of the thirteenth session of the Committee

11. Closure of the session

APPENDIX III

Review by RSMC Nadi for 2008/2009 and 2009/2010 tropical cyclone seasons

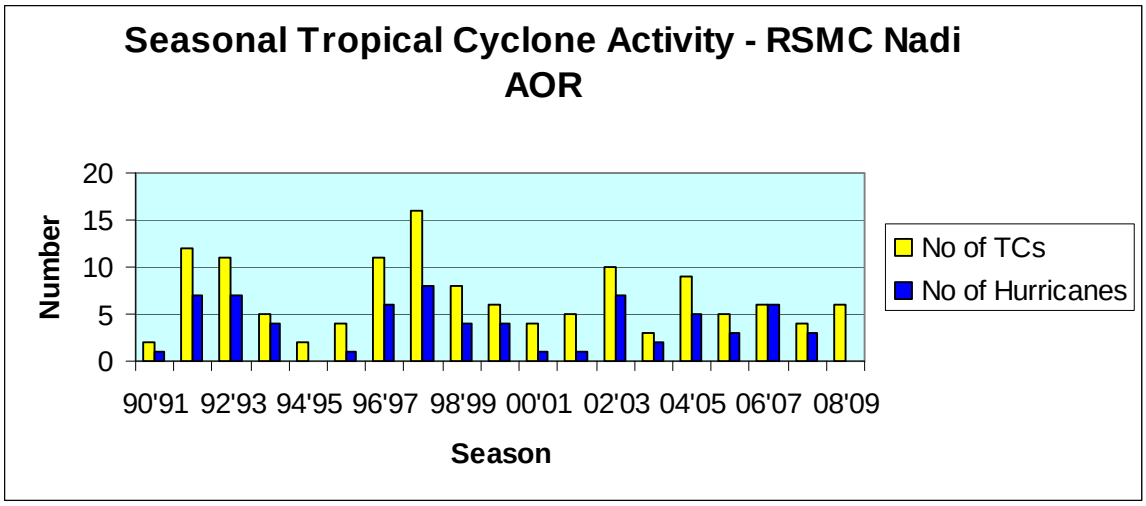
TROPICAL CYCLONE SUMMARY
2008-2009 Season

Introduction

A summary is presented of tropical cyclone activity during the 2008/2009 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 2008/09 Tropical Cyclone Season, tropical cyclone activity in the RSMC Nadi AOR was well below its climatological average, a trend observed for the last four seasons, since 2004/05. In total, only six tropical cyclones occurred in the region. Four of these cyclones attained storm intensity (category 2) while the remaining two were gales (category 1). None of the cyclones attained hurricane intensity.

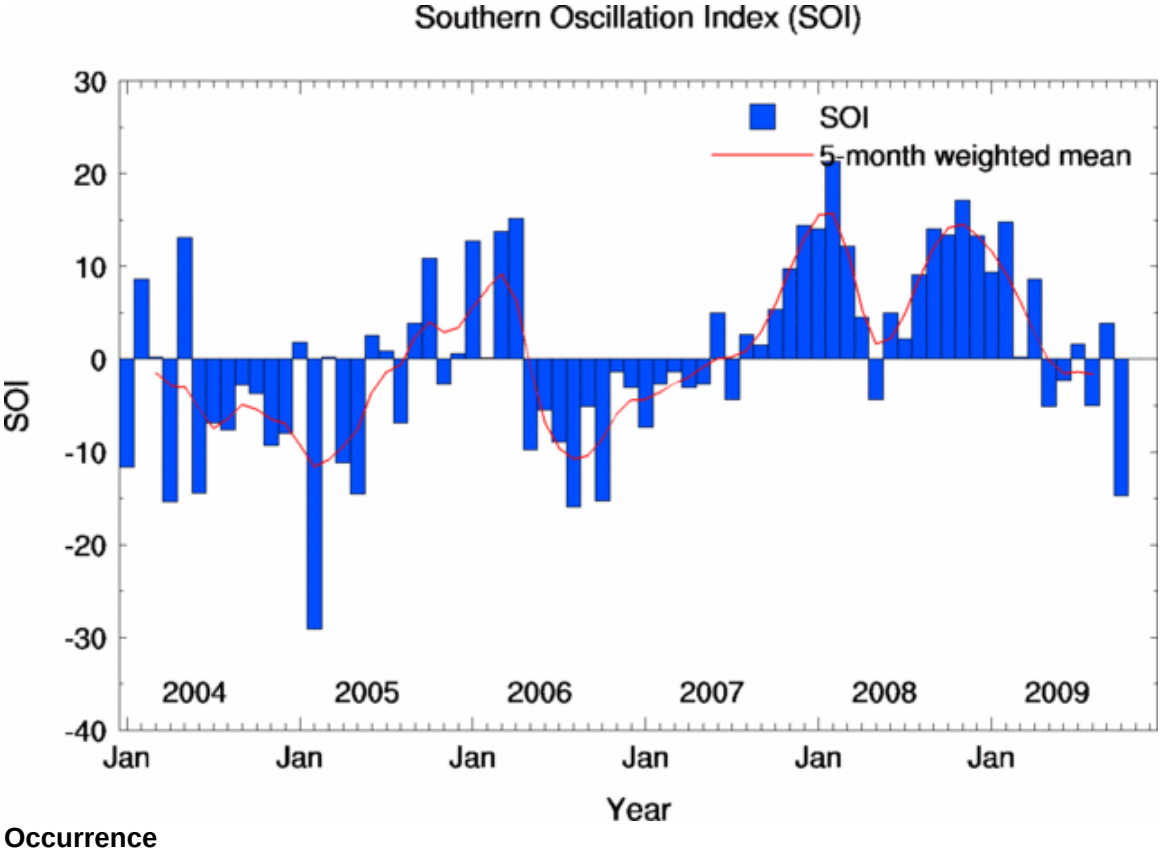
Figure 1 Tropical Cyclone Activity in RSMC Nadi AOR by Season



Climatic Indices

At the beginning of the season, ENSO was neutral, with SOI values about 1 standard deviation. Towards December, cool La Niña-type conditions developed, with values greater than 1 standard deviation above the long term mean. However, towards the end of season, neutral conditions returned. (refer **Figure 2**). Central near-equatorial Pacific Ocean sea surface temperature (SST) showed a cooling trend from October but did not approach values typically associated with La Niña events until January, and then only briefly. SST returned to small anomalies towards the end of the season. Cloudiness was less than normal about the near-equatorial date-line throughout the season. Easterly low-level wind anomalies prevailed over the near-equatorial western Pacific Ocean for much of the season [though generally they did not extend further east in the Pacific]. Towards the end of the season, anomalies over the central near-equatorial Pacific eased somewhat. The active MJO phase generally coincided with increased convective activity in the region, though pulses waned in the beginning of the season, influenced by La Niña. MJO periodicity varied between 30 and 45 days.

Figure 2 Southern Oscillation Index values vs 5-Month Running Means



Occurrence

A total of fifteen significant tropical disturbances were monitored and assigned numbers of the series (01F, 02F,…..etc) in the 2008/9 Tropical Cyclone Season by RSMC Nadi. Only six out of these fifteen developed into tropical cyclones. All six cyclones occurred in the period between the last week of January 2008 and the first week of April 2009. The activity could be seen as occurring in pairs; two over to the east of the Dateline, two about the Dateline and the other two in the Coral Sea region. One cyclone developed inside Brisbane's area (was named by Brisbane TCWC) before it moved into Nadi's AOR. Interestingly, *Hettie* was named on the 28th of January, exactly one year later to the day that the last cyclone in the basin, *Gene*, was named, making this the first 12-month cyclone-free period observed in the South Pacific since the advent of meteorological satellites.

Table 1 Tropical Cyclones in the RSMC Nadi area of responsibility, for the 2008/9 Season. All dates and times are in UTC1.

	Low first identified			Initial tropical cyclone phase			
Name	Date	Lat.	Long.	Date	Time	Lat.	Long.
Hettie	25 Jan	12.0°S	177.0°E	28 Jan	0900	21.3°S	177.4°W
Innis	13 Feb	18.4°S	174.4°E	17 Feb	0600	21.9°S	163.9°E
Joni	10 Mar	19.0°S	157.0°W	11 Mar	1200	21.7°S	158.5°W
Ken	16 Mar	19.0°S	164.0°W	17 Mar	0600	21.7°S	162.4°W
Jasper*	23 Mar	14.7°S	154.2°E	23 Mar	1800	16.0°S	157.3°E
Lin	02 Apr	15.2°S	178.3°E	03 Apr	1800	16.6°S	176.4°W

1 UTC - Universal Co-ordinated Time (same as Greenwich Mean Time)

Name	Maximum Intensity (knots) Date	Time	Lat.	Long.	Int	Cat.	End of Tropical Cyclone Phase Date	Time	Lat.	Long.
Hettie	28 Jan	1800	22.1°S	177.5°W	35	1	29 Jan	0600	23.2°S	177.8°W
Innis	17 Feb	1200	23.4°S	162.4°E	40	1	18 Feb	0000	27.4°S	161.0°E
Joni	13 Mar	0000	26.3°S	159.5°W	55	2	18 Mar	1800	31.3°S	159.2°W
Ken	18 Mar	1800	25.8°S	159.7°W	50	2	19 Mar	1800	31.9°S	155.2°W
Jasper*	24 Mar	0600	19.1°S	160.6°E	50	2	25 Mar	1200	21.3°S	163.7°E
Lin	05 Apr	0600	23.1°S	174.9°W	60	2	06 Apr	0000	26.3°S	173.1°W

* named by Brisbane TCWC

Verification Statistics

Position forecast verification statistics for each cyclone (**Table 2**) was derived by comparing the initial and forecast positions (given in warnings issued by RSMC Nadi-TCC) with post analysis 'best track' positions.

Overall, initial position errors for individual tropical cyclones were similar to previous Seasons. However, relatively large errors associated with *Hettie,* and *Innis,* were attributed to difficulties in locating the centres, which were constantly overshadowed by dense cirrus, during development stage and for *Jasper*, during dissipation.

At 12- and 24-hour forecast times, forecasts consistently displayed good skill over persistence, for all cyclones, except for *Hettie* and *Joni*. This was attributed to difficulties in forecasting *Hettie's* southward turn and Joni's slowing before resuming its original southeast course.

Figure 3 RSMC Nadi Forecast Errors.

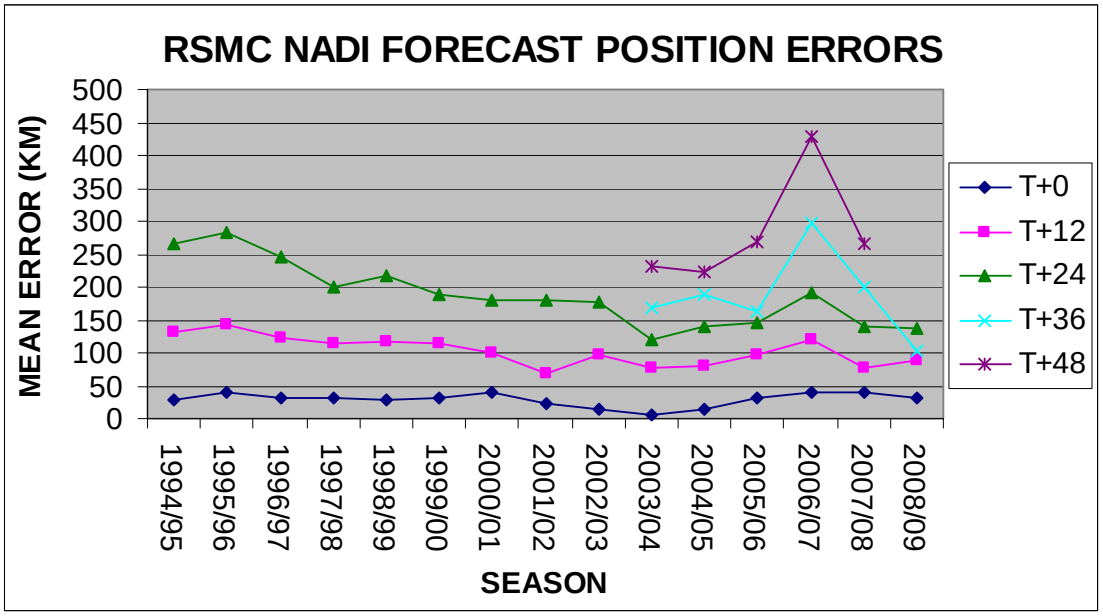


Table 2 Position forecast verification statistics for official warnings issued by RSMC Nadi. Forecast positions are verified against the official best track. Persistence errors (in brackets) are included for comparison.

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.
Hettie	45	17	120(91)	4	-	-	-	-	-	-
Innis	41	12	-	-	-	-	-	-	-	-
Joni	24	8	39(72)	4	-	-	-	-	-	-
Ken	20	8	114(167)	4	-	-	-	-	-	-
Jasper*	44	6	107(271)	3	-	-	-	-	-	-
Lin	14	12	75(160)	7	85(322)	4	-	-	-	-
Aggregate	32	63	90(148)	23	137(234)	7	102(126)	1	-	-

* named by Brisbane TCWC

In **Table 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. The significant southeast bias displayed by *Ken* at 12-hours, was attributed to forecasts consistently moving the cyclone southeast while it slowed and drifted southwards, before returning to a southeast course. Similarly, for *Jasper,* the northwest bias at 12-hours was due to the cyclone slowing on its southeast track before eventually turning northwest whilst weakening.

Table 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.

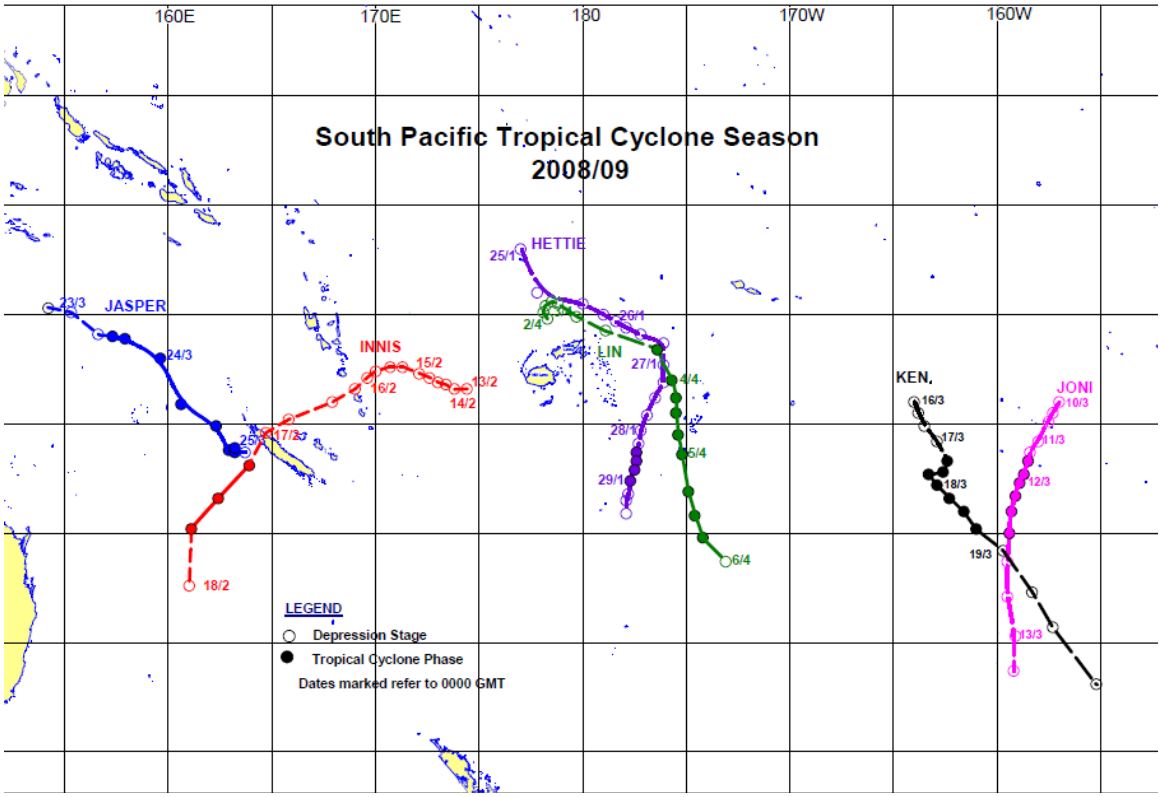
Lead-time	**0 hours**		**12 hours**		**24 hours**	
Name	Centroid E-wd, N-wd	Radius of 50% circle	Centroid E-wd, N-wd	Radius of 50% circle	Centroid E-wd, N-wd	Radius of 50% circle
Hettie	-5,1	43	-90,-45	50	-	-
Innis	-7,-4	49	-	-	-	-
Joni	9,11	25	25,11	25	-	-
Jasper*	-36,9	40	-100,22	123	-	-
Ken	2,1	15	43,-102	83	-	-
Lin	2,4	15	12,25	57	56,78	66
Aggregate	-4,1	39	-13,-16	103	-23,-20	155

Table 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
Hettie	-	-	-	-
Innis	-	-	-	-
Joni	-	-	-	-
Jasper*	-	-	-	-
Ken	-	-	-	-
Lin	-	-	-	-
Aggregate	62,-39	187	-	-

- **named by Brisbane TCWC**

Figure 4 Tracks of *Hettie, Innis, Joni, Jasper, Ken and Lin.*



Tropical Cyclones in the RSMC Nadi Area of Responsibility (AOR), 2008/2009 Season.

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

Hettie (08F): 28 - 29 Jan 2009

Hettie was the first cyclone in the RSMC Nadi AOR in the 2008/9 Season. It was named a year after the previous season's last cyclone was named. As a cyclone, Hettie (category 1) existed over waters between Fiji and Tonga for less than one day. It had a peak intensity of 35 knots.

TD 08F was first identified by RSMC Nadi as a tropical disturbance north of Rotuma on January 24th, 2009. The system was embedded in a monsoon trough, with minimal vertical shear, and moving steadily towards the southeast. On the 25th, it was upgraded to a tropical depression, whilst located near Rotuma. For the next three days, it maintained a track between Fiji and Tonga intensifying slowly, against relatively stronger shear, with convection flaring on the eastern boundary of the low-level circulation centre. Good outflow channels also developed over the depression as it began to turn southwards. It was upgraded to a cyclone and named later on the 28th while located to the far southeast of Fiji and southwest of Tonga, and heading south-southwest. With strengthening shear and cooler waters, *Hettie* was downgraded to a depression on the evening of the 29th. The cyclone did not directly affect any inhabited land area.

Innis (10F): 17 February 2009

Innis, like *Hettie,* was a short-lived system. As a cyclone, *Innis* lasted for only 18 hours. Its peak intensity was estimated at 40 knots.

TD 10F developed along an active convergence zone, between Fiji and Vanuatu on February 13th. Through the 15th, whilst moving westwards across Vanuatu, hostile environmental conditions were evidently influencing its potential to become a tropical cyclone. Around this time, gale force winds were observed in the eastern semi-circle but still some distance away from the centre. Upon leaving Vanuatu, it turned southwest and headed for New Caledonia. Outflow over the depression developed as it did, with primary bands beginning to wrap around the centre. As the depression approached New Caledonia, future prospects of attaining tropical cyclone status were undermined by increasing shear and interaction with this imposing and rugged landmass.

However, at 0600 UTC on the 17th, the system crossed over New Caledonia into relatively lower shear region with strong divergence aloft. With primary bands consolidating and wrapping tightly around the centre, TD 10F was then named *Innis.* After a brief period of development, though, shear caught up with it yet again early the next morning. Primary responsibility for warnings was handed over to TCWC Wellington as the exposed centre moved in their AOR. *Innis* was downgraded into an extra-tropical low in their first warning at 180000 UTC.

Joni (11F): 11 – 12 March 2009

Joni was a hybrid that eventually spun downwards to the surface from the upper levels of the troposphere on the 10th. Inside Nadi AOR, it attained a peak intensity of 55 knots. *Joni* was a small and compact system. Because of its small size it fortunately sailed through the Southern Cooks without any serious impact on any inhabited islands.

As the upper circulation touched down just west of Mauke and Mitiaro in the Southern Cooks on the 10th, it was designated a tropical depression TD 11F by RSMC Nadi. This was well supported by microwave and quikscat data. The system was then moving south-southwest

and forecast to trek between Rarotonga and Mangaia. Through the 11th, shear decreased sufficiently to allow significant overall development. On the evening of the 11th, with the system moving into minimal shear, and outflow aloft becoming well-established, its probability of becoming a tropical cyclone in the next 12 hours was raised to high. At 111200 UTC, it was named *Joni* with 35 knots close to the centre and whilst located about 40 nautical miles west-northwest of Mangaia and about 70 miles east-southeast of Rarotonga. With favourable conditions, the cyclone continued to intensify and attained storm intensity 18 hours later. *Joni* reached peak intensity as it neared 25 South latitude, the Nadi and Wellington border. Wellington accepted primary responsibility for further warnings beginning at 130000 UTC as the cyclone moved into their AOR. *Joni* remained a cyclone for another day before it was downgraded to a low. There was only minimal impact reported in the southern Cook Islands with reports of heavy rainfall on Mangaia.

Ken (12F): 17 – 18 March 2009

Ken could be described as *Joni's* mirror image, originating over the western parts of the Southern Cooks on the 16th of March and following a south-southeast course. *Ken* attained a peak intensity of 50 knots while inside Nadi AOR.

Late on the 15th a weak tropical disturbance, later identified as TD 12F, was observed over the western parts of the Southern Cooks about 24 hours after *Joni* was downgraded to a *Low* to the far south of Rarotonga. On the 16th, TD 12F was upgraded to a tropical depression as convection erupted about the centre, spiral bands wrapping around it and outflow developing aloft. With an approaching thermal trough from the west, the potential for this system becoming a tropical cyclone in the next 24 hours was raised to high. At 170600 UTC, 12F was named *TC Ken* with 35 knots close to the centre and gales within 100 miles of the centre. With decreasing shear and an amplifying thermal trough approaching from the west, *Ken* was anticipated to intensify rapidly in the next 24 hours. This eventually happened early on the 19th as the cyclone approached Nadi's southern boundary with Wellington, but only after some weakening through the 18th. TCWC Wellington assumed primary responsibility for further warnings on *Ken* from 190000 UTC as the system accelerated southeast. 24 hours later, the cyclone was downgraded to a *Low* as it accelerated further into the high seas. *Ken* did not cause any damages to any inhabited island.

Jasper (13F): 24 – 25 March 2009

Jasper moved into RSMC Nadi's AOR, from TCWC Brisbane's region, as a category 2 cyclone with wind speeds of 50 knots close to the centre, late in the afternoon of the 24th March. At this time, convection erupted about the centre and well-corroborated by the corresponding microwave data which showed good and intense low-level circulation. Outflow over the system was good to the south but inhibited elsewhere. However, overnight, convection warmed considerably with shear tearing the cold tops to the south of the low-level centre. Later on the 25th, increasing shear and dry air entrainment caused its demise and was subsequently downgraded to a depression at 251200 UTC.

Torrential rain caused flooding especially in the northern parts of New Caledonia, where it was reported some families were evacuated. Very high seas and damaging heavy swells caused beach erosion along the western coastlines of New Caledonia. Reports also indicated that a few power lines were felled by high winds, leaving some residents without power.

Lin (14F): 3 – 5 April 2009

Lin was the 6th and final cyclone inside RSMC Nadi AOR in the 2008/9 Tropical Cyclone Season. It formed just north of Fiji and maintained a general southeast track during its lifespan. Peak intensity attained was 60 knots. The cyclone tracked directly over Tongatapu where it caused some damage.

TD 14F was first identified by RSMC Nadi as a weak tropical disturbance embedded along an active monsoon trough just north of Fiji on the 1st of April. On the 2nd, it was classified as a tropical depression while located to the northeast of Fiji and heading southeast. Around this time, another shallow disturbance was located further to its east and drifting southwards. Through the 3rd, this second system was absorbed by 14F's circulation, between Tonga and Fiji. Overall organization at this time was still poor with convection struggling to consolidate under shear and diurnal influences. Overnight of the 3rd, though, convection erupted over the centre with the primary band to the east wrapping tightly around the centre. On re-analysis, TD14F attained cyclone status around 031800 UTC while located to the north-northwest of Nukualofa and gradually accelerating towards the southeast. Through the 4th, the cyclone moved into minimal shear with good outflow channels aloft. 12 hours later, at 040600 UTC, *Lin* was upgraded to a storm with 50 knots close to the centre. The cyclone intensified further under favourable conditions and reached a peak intensity of 60 knots while located about 15 nautical miles south-southeast of Nukualofa. As it left Tonga, interaction with drier air and shear increased. This was aided by an approaching upper-trough from the west. At 051800 UTC, intensity was reduced to 45 knots with further weakening anticipated due to stronger shear and cooler waters. Wellington took over warnings for the cyclone from 060000 UTC and downgraded *Lin* to an extra-tropical system in their first warning. Wellington maintained warnings on the *Low* formerly *Lin* until the 8th.

In Tonga, reports noted that high winds knocked down power lines in Nukualofa. Some flooding in Tongatapu was triggered by accompanying heavy rain.

References:

1. **Australian Bureau of Meteorology web site**, http://www.bom.gov.au/, for Monthly SOI values and 5-month running mean.

2. **Padgett G and Padua M.V.,** Global Monthly Tropical Cyclone Activity Summary.

TROPICAL CYCLONE SUMMARY
2009-2010 Season

(to be added)

APPENDIX IV

Reports of the Members on tropical cyclone activities in the South Pacific and South-East Indian Ocean areas during 2008/2009 and 2009/2010 seasons

TONGA

2008/2009 TROPICAL CYCLONE SEASON

1. TROPICAL CYCLONE "LIN" (03-05 APRIL 2009) – CATEGORY 2

The cyclone developed from a tropical depression (TD14F) which formed in this monsoonal trough just north of Fiji. TD14F moved South East and intensified into a tropical cyclone on 4 April 2009 when it was 135km SSW of Niuafo'ou. Tropical Cyclone "LIN" then moved south along the Western side of the Tonga islands. The system was named by the Nadi Regional Specialized Meteorological Centre (RSMC) at 032030UTC

A total of 19 Special Weather Bulletins were issued by the National Weather Forecasting Centre Fua'amotu.

The Observations recorded by Meteorological Stations throughout Tonga during Tropical Cyclone "LIN" were as follows.

Station	Mean speed/Dir/Time	Max Wind	MSLP/Time	24Hr rainfall recorded at 0000UTC
Fua'amotu	340/38KT/050000	56KT/050000	987hPa/042300	137mm (5th)
Lifuka	330/40KT/042200 Est.	50KT/042200	998hPa/041600	95mm (5th)
Lupepau'u	030/35KT/040800 Est.	50KT/040800	1001hPa/041500	118mm (4th)
Keppel 3	30/20KT/040600 Est.	30KT/040600	No Barometer	57mm (4th)
Niuafo'ou	340/25KT/040100 Est.	35KT/040100	1000hPa/040100	153mm (4th)

TRACK OF TROPICAL CYCLONE "LIN"

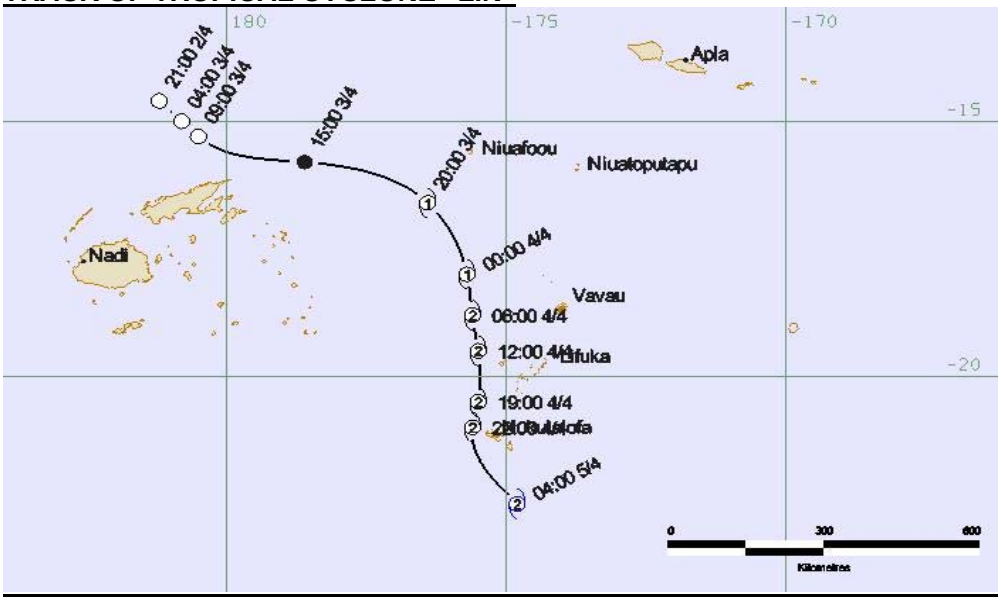


Figure 1. Track of Tropical Cyclone "LIN" plotted by NWFC Fua'amotu, Tonga

DAMAGES
Damages were mostly to crops (mostly banana and taro) and fruit bearing trees (mostly breadfruit) with little structural damage. Although there was some damage to the Stevenson screen at the HF radio antennae at the Fua'amotu Met. Office.

2009/2010 TROPICAL CYCLONE SEASON

1. TROPICAL CYCLONE "MICK (12-16 DECEMBER 2009) – CATEGORY 2

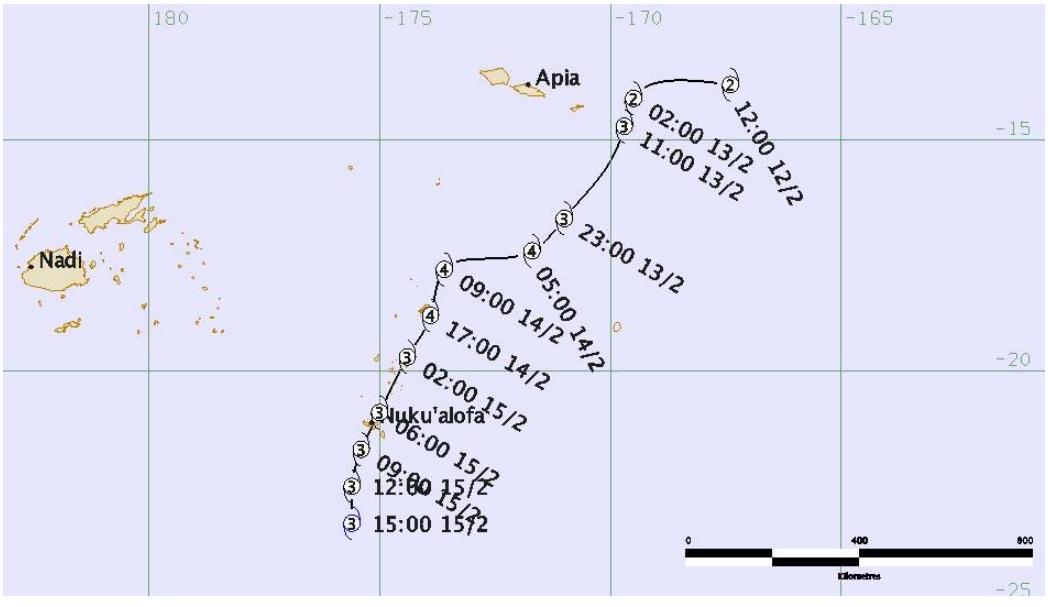
Tropical Cyclone "Mick" developed from TD 01F northwest of Fiji and crossed the main island of Fiji Viti and moved southeast towards Tonga. Although 6 Special Weather Bulletins were issued for Tonga includin a Cyclone Warning for Southern Tonga, TC Mick was sheared off almost completely back to a tropical depression when it was about 375km west northwest of the main island of Tongatapu at 150600UTC. It continued to weaken very rapidly as it passed to the south Tonga. The strongest sustained winds recorded at the Fua'amotu Meteorological Station was 19knots gusting to 33knots at 151400UTC. Lowest pressure recorded was 1005mb at 151600UTC. Total rainfall recorded from 150000UTC to 160000UTC was 152.2mm

DAMAGES
There was minimal damages to plantations reported.

1. TROPICAL CYCLONE "RENE" (12-16 FEBRUARY 2010) – CATEGORY 4

Tropical Cyclone "Rene" developed from a tropical depression to the east of the Samoa's. It intensified in to a Severe Tropical Cyclones and tracked southwest over the main island groups of Tonga. It developed and peaked to a Category 4 as it reached Central Tonga but then decreased back to a Catergory 3 as it hit the main island of Tongatapu. It is believed that the 'Eye' passed over the main island as there was a calm period for about 20mins as the Cyclone passed overhead. It continued to weaken very slowly as it passed to the south Tonga. The strongest sustained winds recorded at the Fua'amotu Meteorological Station was 43knots gusting to 83knots at 150700UTC from the 120. Lowest pressure recorded was 969mb at 150800UTC and a total 149mm of rainfall was recorded in the 12hrs from 150000UTC to 151200UTC. Tha total of 22 Special Weather bulletins was issued by the NWFC Fua'amotu for Tonga.

TRACK OF TROPICAL CYCLONE "RENE"



DAMAGES

Tropical Cyclone “Rene” caused significant damage to vegetation, totally destoryed a mango crop and half of breadfruit in season. Structural damage was limited mostly to power lines and poorly build structures. About 30% of powerlines were affected and took about 1 week to restore on Tongatapu. The most damage reported was structural damaged on the island of 'Eua a high rising island about 25miles South East of Tongatapu with some 22 homes reporting extensive roof damage and an estimated 60 hectares of prime pine forest affected. Extensive sea flooding was experienced along the eastern coasts of the Tonga islands destroying coastal habitats and homes on Vava'u and many graves near the sea on Tongatapu were dugup and destryed by the surging waters. The inter-island MV Fangaafa also ran aground on Sopu reef. The Ha'apai Met Station Stevenson Screen was damaged.

TROPICAL CYCLONE “TOMAS” (10-17 March 2010) – CATEGORY 4

Tropical Cyclone “Tomas” tracked through the Fiji Islands it did affect the Southern Tonga Islands. Only strong wind warinings were issued by the NWFC Fua'amotu for the whole of the Tonga group, however at 160100UTC (when TC Tomas was about 400km south of Tongatapu) winds were recorded at 30kts gusting 47kts from 040 with a barometer reading of 1005mb at Fua'amotu Station. No Special Weather Bulletin was issued for Tonga but probably gale warnings were warranted. A Damaging Swell warning however was issued for the northern, west and soouthwest costs of all the Tongan islands.

TRACK OF TROPICAL CYCLONE “TOMAS”

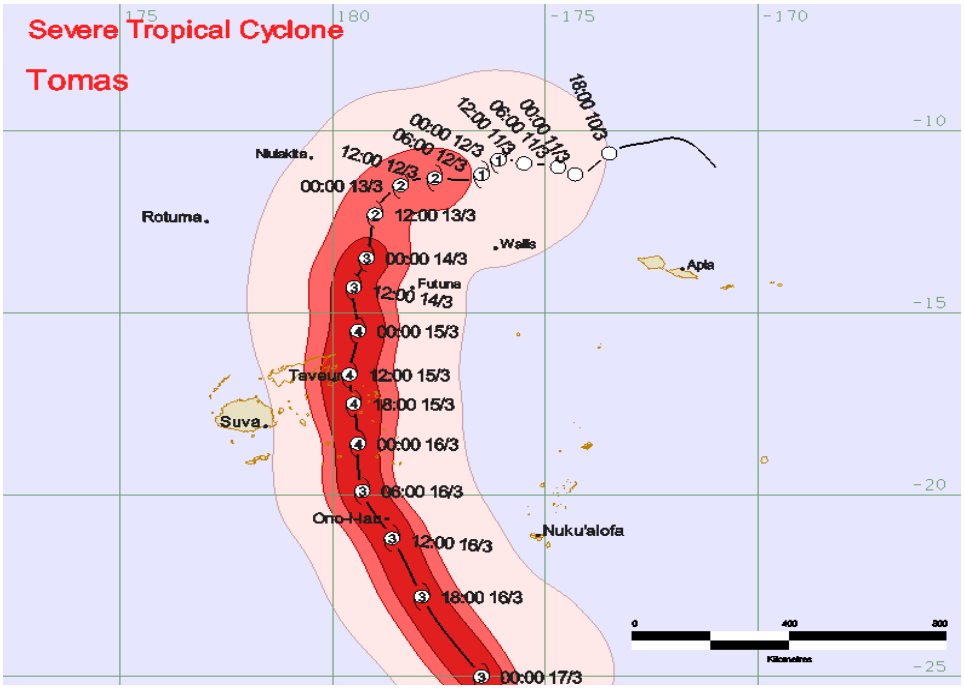


Figure 3. Track of Tropical Cyclone “TOMAS” plotted by RSMC Nadi, Fiji

DAMAGES

There was some damage to vegetation and minimal damage to structures however a 3-4m storm surge was reported on the west coast of Tongatapu although no major

damages were reported.

Recomendations

1. Support for enhancement of media presentations

2. Consider RSMC Wellington putting SWB's for Pacific Islands on EMWIN in the event of failure or partial failure of RSMC Nadi

3. mprove detection and forecasting storm surge and heavy rain associated with TD's and TC's

4. Consider broadcasting Severe Weather Demonstration project products on LRIT

5. Develop an on-line Forecaster and Observer course for the Southern Hemisphere

6. Technician training to support observation network

7. Tsunami Training (including developing awareness materials and programs)

8. Amend TC Operation Plan to formalize issue of Tropical Cyclone Warning in cases where a system has not been named but is expected to reach TC strength and make landfall in 24

Cyclone season 2008-2009
Report from New Caledonia and Wallis & Futuna

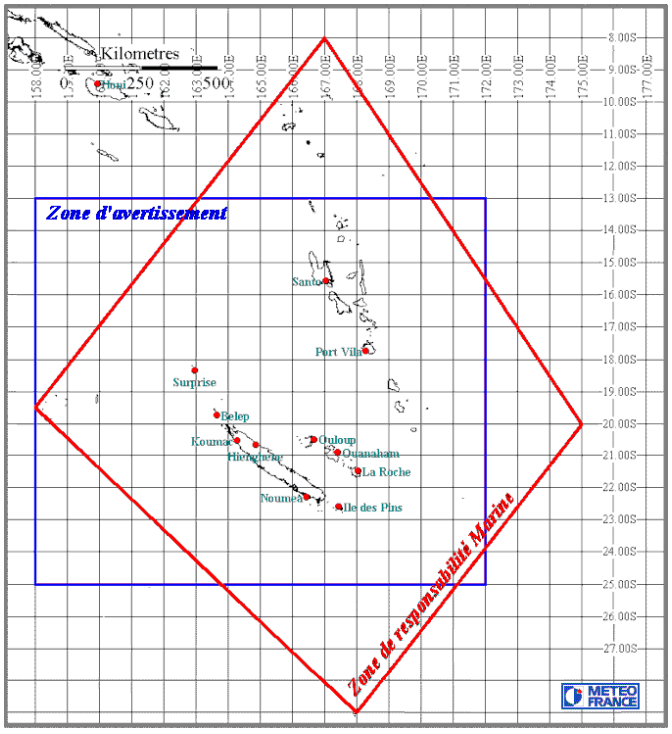
General context

Météo-France New Caledonia Met Service has defined a cyclone warning zone (in blue square) and a marine warning zone (in red diamond) for which it issues special bulletins.

If a system enters - and is forecasted to remain - in our cyclone warning zone we recommend to Civil Safety Authorities a pre-alert status.

If a system is forecasted to threaten or strike New Caledonia (and dependencies Loyalty Islands and Isle of Pines) within 18 hours, we recommend alert status moves to orange alert level. Schools and businesses are to close during orange alert. People are to secure habitat and belongings.

If the system is within 6 hours of striking our territory, alert switches to red and populations are to remain confined in sturdy habitat.

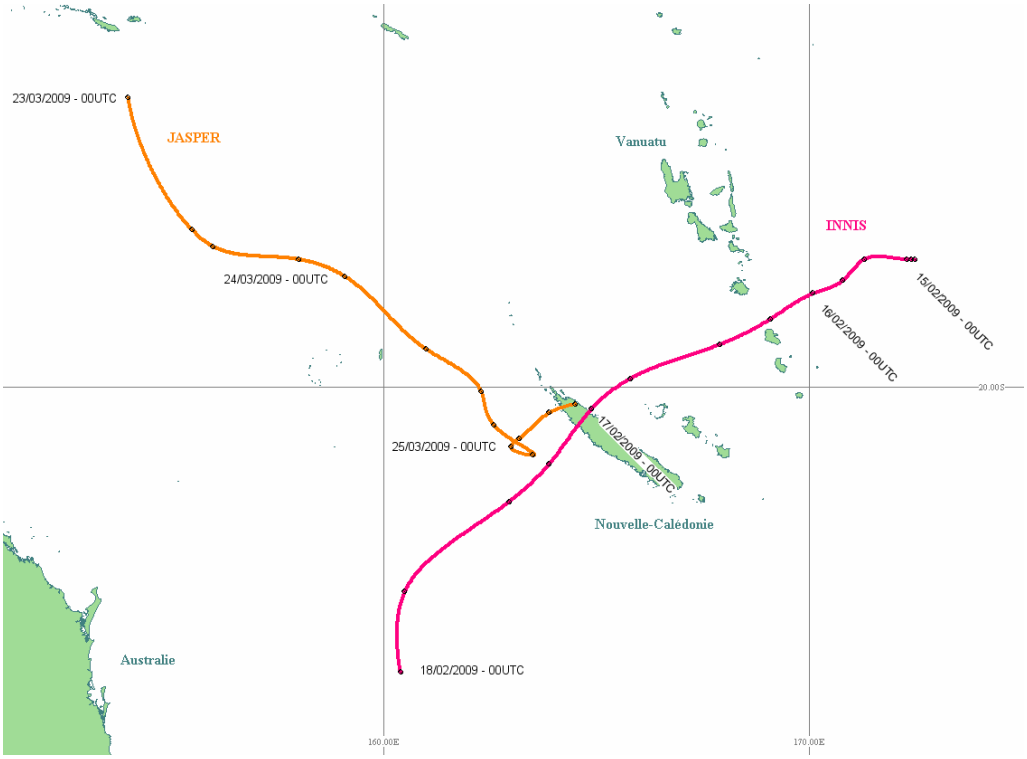


Wallis and Futuna has an older alert system with no colour codes but numbered (level 1 and level 2) alert levels.

Table of tropical phenomena that have entered our zone during the 2008-2009 season

Name	**Maximum development**	*Period*
Innis	Gale force tropical cyclone	14 – 24 February
Jasper	Storm force tropical cyclone	22 – 26 March

The 2008/2009 cyclone season went on with neutral ENSO conditions. Little activity was recorded with only 2 phenomena in our warning area. The season lasted a mere 40 days with a late start in mid February and ended early in late March. Few cyclones were recorded overall in the SW Pacific. No systems were recorded for Wallis & Futuna.



Innis : Gale-force tropical cyclone

A low pressure system forms on the13th of february off the coasts of Fiji and builds up as it moves on towards Vanuatu. It passes over Vanuatu and heads towards the north of New Caledonia. It becomes more organized and reaches gale force status on the 17th whilst passing over the main island. It is then named Innis par by RSMC Nadi.

Innis will rapidly move on to the south and then south-westerly to become extra tropical.

Innis did not spurn any official cyclonic alert on the territory (alerts are for storm force tropical cyclones and above). Our new vigilance system went into action and allowed

us to warn authorities and the public at large of heavy rainfall to come. Orange vigilance level was instated on most parts of the territory.

Heavy rainfall (> 100mm over 48 hours) was observed in some places without important damage. Mean 10 minute winds did not reach 30 knots (except Thio on the South-East coast with a 43 kts recording) but some strong gusts were nonetheless recorded : 55 kts at Thio and at Koniambo (West coast), 47 kts at Poindimié (East coast) and Népoui (West coast).

Jasper : Storm-force tropical cyclone

A low-pressure system forms on the 22nd of March over the Coral sea south-east of Papua NG. It rapidly takes a south-easterly trajectory while building up. It is christened Jasper on the 23rd at 18 UTC, becomes storm force cyclone on the 24th at 00 UTC. On the 25th Jasper starts to break up as it reaches the north of New Caledonia's main island. Cyclonic pre-alert is instated on the 24th and maintained on the 25th. We did not need to instate orange alert status as the threat did not confirm. On the other hand, Jasper approached our territory in the midst of an already existing heavy rainfall episode. Orange vigilance (for heavy rainfall) was already instated and was held during Jaspers approach. This created some confusion in the general public as orange alert was not decided but orange vigilance was in effect.
Local flooding was observed in many places and the evacuation of several families was carried out in the north of the main island. Rough seas produced by the storm caused beach erosion along the coastlines of New Caledonia. High winds caused localized structural damage and knocked down a few power lines, leaving some residents without power.

(Partial) summary of cyclone season 2009-2010
Report from New Caledonia and Wallis & Futuna

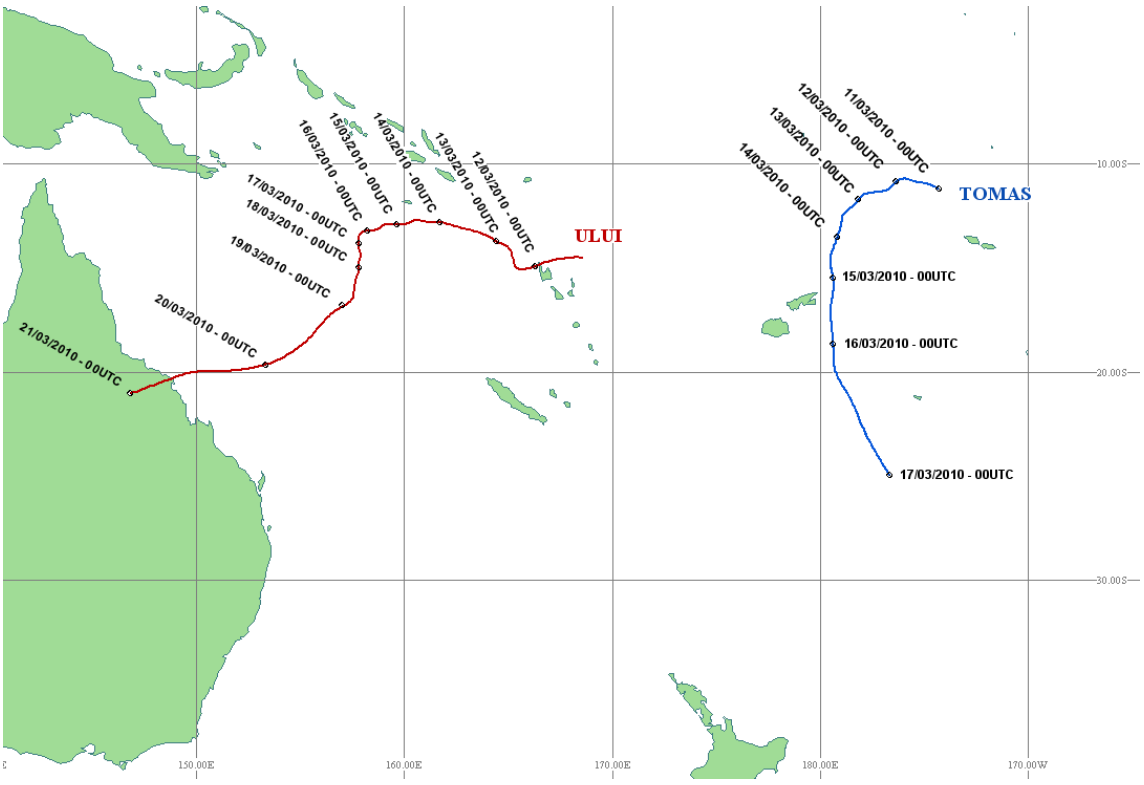
The 2009/2010 season starts with moderate El Nino conditions. Cyclonic activity is shifted easterly towards the centre of the Pacific.
Activity starts belatedly in the New Caledonia zone with cyclone Ului on March 12th. It forms in northern Vanuatu off Santo and moves westerly along the north rim of our alert zone without threatening New Caledonia. Whilst technically within our zone, it is decided with civil safety authorities that there is no need to instate a pre-alert status as all track forecasts maintain the system away from us. The system moved westerly very slowly before taking a southerly and then south-westerly trajectory crossing the Coral Sea before striking barrier reef islands and eventually the Queensland coast.
In about the same time, cyclone Tomas forms north of Wallis Island and is forecasted to move west and then south and threaten Futuna Island (population is about 4000). Météo France's New Caledonia Met Service has jurisdiction over Wallis and Futuna and therefore provides model outputs, guidance and technical assistance to Wallis and Futuna weather service who in turn provided Civil Safety authorities with all necessary decision-making information. 24x7 shifts were activated in both Wallis and Nouméa offices.
Tomas will pass 200km west of Wallis and only 100km from Futuna on the 17th. No casualties were reported but severe damage to coastal areas, crops (80% destroyed) and infrastructure occurred on Futuna. Most traditional "fales" were damaged or destroyed. Telephone lines were cut off for over 48 hours and we had no news of our 2 observers on Futuna during that time. The semi-automatic weather station ran out of battery power early on the 17th and therefore we did not record maximum wind speed at Futuna's synoptic station. At the time of this report's drafting, Futuna airfield is still running on generators but is operational allowing aid to come in rapidly.

Fiji's Vanua Levu and neighbouring islands will be badly hit after that.

Name	**Maximum development**	*Period*
Tomas	Cyclone force tropical cyclone	11-17 march 2010
Ului	Cyclone force tropical cyclone	12-21 march 2010

NWP models – especially ECMWF – demonstrated amazing accuracy for both systems' evolution in the 00-48H time-frame.

[Details of each system to be completed]



General Information

On March 22nd 2010, New Caledonia Met Service upgraded its permanent telecom link with Météo France's internal network. It now has 512kbps (previously 128) throughput allowing more NWP fields and much needed ease in accessing central data bases and central production servers (like Météo France's climate services data base). It also has a 512kbps permanent VPN (Virtual Private Network) link reserved for HTTP traffic – a much cheaper link but not as reliable and robust as a permanent link for receiving crucial data. Its current 64kpbs permanent link with Melbourne will be upgraded to 256kpbs during the course of 2010 as contracts are up for renewal.

Wallis Island has now a 256kpbs DSL subscription with an additional secured password VPN software package allows connecting to Météo France's internal network.
2010 is also the year where production tools will change considerably in New Caledonia: "Synergie" workstation version 4.4 has finally seen the long-awaited "cyclone module" implementation. This module was included in the software distribution after a long period of testing mainly by RSMC La Réunion (Indian Ocean). It is able to export CXML file formats to a downstream production/graphics tool. Our new production server is currently in its implementation phase and should be fully functional by the start of the 2010-11 cyclone season.

Country Report for American Samoa, United States of America

The 2008-2009 tropical cyclone season for American Samoa was very quiet. American Samoa was only remotely affected by two tropical depressions, and neither caused significant problems for the islands of American Samoa. During the 2009-2010 tropical cyclone (TC) season, four TCs, Nisha, Oli, Rene and Sarah formed near or passed closed to American Samoa. Only Cyclone Rene caused significant impacts to American Samoa, and that was primarily to the Manu'a Island Group. Rene was a strong Category 1 hurricane when it hit the Manu'a Island Group, and it caused extensive damage to agricultural vegetation, as well as major beach erosion and coastal flooding of low lying areas. Unfortunately, there was one indirect fatality. The highest winds recorded were 30 (1-min avg) G55 mph (1-min avg) at WSO Pago Pago and 43 (1-min avg) G82 mph from the Automated Weather Station on Ta'u Island. Two additional issues were discussed: (1) the September 29, 2010 earthquake and tsunami, and (2) mudslide prediction. The forecast method and criteria for Micronesia was provided as was a PowerPoint presentation showing the mechanism of the mudslide.

Weno Island, Chuuk, Federated States of Micronesia (FSM) after the July 2002 mudslide event. (Photo courtesy of Dr. Ed Harp, US Geological Survey)

APPENDIX V

Technical Plan and Implementation Programme (2010–2014)

1. PROVISION OF TRAINING & CAPACITY BUILDING

Activities	Strategies	Stakeholders	Key Performance Indicators
Satellite product interpretation training	To take advantage of satellite training workshops and courses where possible	Members requiring these skills	Opportunities taken where available
Tropical cyclone forecasters mentor training	To conduct mentoring missions	Members requiring this training	At least 2 visits.
RSMC/TCWC attachment training	To send forecasters to either RSMC Nadi, Australia TCWCs or RSMC Honolulu (Pacific Desk)	All Members	Minimum of 5 per year.
Media skills training	To conduct a workshop in 2011, including other related initiatives.	10 Pacific Member Countries	Workshop completed.
Technical maintenance training	**To send technician(s) with a wide range of skills to countries in need**	Members requiring technical know-how	Workshop completed.

2. COMMUNICATIONS & IT UPGRADE

Activities	Strategies	Stakeholders	Key Performance Indicators
Emergency Equipment	To equip with suitable backup communications	Members without backup	All Members with backup communications capability
RANET	To expand existing network	Members in need	2 new installations

3. OBSERVATION NETWORKS UPGRADE

APPENDIX V

Activities	Strategies	Stakeholders	Key Performance Indicators
Observations Networks • **Preserve & expand RBSN**	To support Pacific GCOS, GUAN & GSN stations	Members with basic set-ups*	At least two countries with upgraded networks.
AWS	To restore, upgrade, enhance and sustain AWS network across RA V TCC area	Members in need	4 additional AWSs installed
Regional Maintenance • **Maintain surface and upper air networks** • **Enhance and broaden GCOS RMC**	To fix ongoing problems & bring up to an acceptable standard	Members requiring assistance*	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.

4. FORECAST & WARNINGS CAPABILITY UPGRADE

Activities	Strategies	Key Stakeholders	Key Performance Indicators
TC Module	To install and maintain the software.	Members with forecasting capability.	Installation of software in PNG.
Combined storm surge & wave data	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.	Task team formed, to set plans and report on progress made on the system.

5. PROMOTE APPLIED RESEARCH

APPENDIX V

Elements	Strategies	Key Stakeholders	Key Performance Indicators
Operational Research • **Tropical cyclone track and intensity forecasting**	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.

APPENDIX VI

RA V Tropical Cyclone Committee's Activities for Possible Future Action

1. PROVISION OF TRAINING & CAPACITY BUILDING

Activities	Strategies	Stakeholders	Key Performance Indicators
Upgrade qualification training	Determine feasibility of a basic meteorology course for trainees with lower entrance qualifications	Kiribati, Niue, Samoa and Tonga.	Feasibility and planning in place by 2010
Management training	To provide management training to NMHSs managers.	Members requiring these skills	Appropriate courses targeted.

2. COMMUNICATIONS & IT UPGRADE

Activities	Strategies	Stakeholders	Key Performance Indicators
Satellite technologies	To purchase and install appropriate hardware and software	Members in need of WEFAX replacement	All those in need upgraded to LRIT
Upgrade IT capability **Operational PCs, workstations and servers**	To replace with or install up-to-date computer facilities.	Kiribati, Solomon Islands and Tonga.	Software and hardware to support at least Win-XP

3. FORECAST & WARNINGS CAPABILITY UPGRADE

Activities	Strategies	Stakeholders	Key Performance Indicators
Graphical TC warning products	To develop appropriate graphics in conjunction with Emergency Management Organisations	RSMC/TCWC, French Polynesia and New Caledonia	Availability of graphical products for all Members.
Development of probabilistic forecasts	To utilise ensemble and climatological data to develop probabilistic fields for winds, rainfall	Members with forecasting capability.	Probabilistic graphical forecast by Nadi by 2009/2010.

APPENDIX VI

4. LINKS TO Disaster Risk Reduction

Activities	Strategies	Stakeholders	Key Performance Indicators
Economic Impacts	To conduct a study on the economic and social impacts of tropical cyclones on SIDS in the Pacific region.	LDC/SIDS	Study completed

5. PROMOTE APPLIED RESEARCH

Activities	Strategies	Stakeholders	Key Performance Indicators
Climate Research • **Quality of Region V section of the southern hemisphere tropical cyclone database**	To eradicate as many of the flaws as possible amongst the existing dataset	Australia, New Zealand, New Caledonia, Fiji and USA	To present progress report at 9th International Southern Hemisphere Atmospheric and Oceanographic Conference
Climate Research • **seasonal prediction scheme** • **Intra-seasonal Forecasting**	MJO based technique to be supported	All Members (south of the Equator), RA V WG on Climate Matters	System being used in forecasting

6. INSTITUTIONAL SUPPORT

Activities	Strategies	Stakeholders	Key Performance Indicators
Comprehensive review of the TCOP	Subcommittee to review and rewrite the existing TCOP	All Members	Completed draft to be part of documentation for 13th Session in 2010

APPENDIX VI

APPENDIX VII

Draft Terms of Reference of the RA V Tropical Cyclone Committee with two Task Teams on Storm Surge and SWFDDP

RESOLUTION xx (XV-RA V) - DRAFT

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

THE REGIONAL ASSOCIATION V,

Noting:

(1) Resolution 6 (Cg-XV) - Tropical Cyclone Programme,

(2) The WMO Strategic Plan (WMO-No. 1028),

(3) United Nations General Assembly Resolutions on the International Strategy for Natural Disaster Reduction (ISDR),

(4) Decisions of the UN Commission on the Sustainable Development of Small Island Developing States (SDSIDS),

(5) Decision of EC-LX on the storm surge watch scheme,

(6) The reports of the sessions of the RA V Tropical Cyclone Committee for the South Pacific and South-East Indian Ocean,

Considering the need for the countries in the South Pacific and adjacent areas affected by tropical cyclones to continue to work together to accelerate action, particularly within the context of the Sustainable Development of SIDS, to reduce the loss of human life and damage caused each year by tropical cyclones and phenomena with impacts similar to those caused by tropical cyclones,

Decides:

(1) To re-establish a working group to be known as the RA V Tropical Cyclone Committee for the South Pacific and South-East Indian Ocean with the following terms of reference:

   (a) To promote and coordinate the planning and implementation of measures for the improvement of cyclone warning systems and related meteorological services and the facilitation of efforts to minimize loss of life, human suffering and damage caused by tropical cyclones and related natural hazardous phenomena in the tropical part of Region V south of the equator;

   (b) To review regularly the status of tropical cyclone warning systems in the RA V Tropical Cyclone Committee area and recommend measures for the development or improvement of these systems;

   (c) To review regularly the Tropical Cyclone Operational Plan for the South Pacific and South-East Indian Ocean and recommend any amendments to the text of the Plan to the President of RA V for approval;

(d) To coordinate its work with other activities carried out within the WMO Tropical Cyclone Programme, in particular with the RA I Tropical Cyclone Committee for the South-East Indian Ocean and ESCAP/WMO Typhoon Committee;

(e) To coordinate its activities with other RA V working groups and rapporteurs;

(f) To develop, update and facilitate the implementation of the Technical Plan of the RA V Tropical Cyclone Committee;

(g) To seek through WMO RA V financial and technical support for the programme activities;

(h) To promote and coordinate the planning and implementation of measures for establishment of the storm surge watch scheme in the Region in collaboration with JCOMM;

(i) To establish sub committees as it finds necessary to carry out the work of the committee;

(2) To invite the following Members of RA V to nominate experts to serve on the Committee:

Australia	Niue
Cook Islands	Papua New Guinea
Fiji	Samoa
French Polynesia	Solomon Islands
Indonesia	Timor-Leste
Kiribati	Tonga
Micronesia, Federated States of	United Kingdom
New Caledonia	United States
New Zealand	Vanuatu

(3) To invite the following Pacific island countries to designate experts to participate in the work of the Committee:

Marshall Islands	Palau
Nauru	Tuvalu

(4) To invite the chairman of RA I Tropical Cyclone Committee for the South-West Indian Ocean to serve as an ex-officio member;

(5) To designate, in accordance with Regulation 32 of the WMO General Regulations, …….. as chairperson of the Committee;

Requests the chairperson of the Committee to submit a report to the sixteenth session of RA V;

Requests the Secretary-General:

(1) To convene biennial sessions of the Committee;

(2) To continue to take the necessary steps to assist the Committee and to ensure the provision of appropriate Secretariat support to its activities.

Note: This resolution replaces Resolution 6 (XIV-RA V), which is no longer in force.