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

TENTH SESSION

(BRISBANE, AUSTRALIA, 10 to 15 JULY 2004)

FINAL REPORT

GENERAL SUMMARY OF THE WORK OF THE SESSION

1. ORGANIZATION OF THE SESSION (Agenda item 1)

1.1 Opening of the session (agenda item 1.1)

1.1.1 At the kind invitation of the Government of Australia, the tenth session of the Regional Association V Tropical Cyclone Committee (RA V/TCC) for the South Pacific and South-East Indian Ocean was held at the Mercure Hotel, Brisbane, Queensland, Australia from 10 to 15 July 2004.

1.1.2 The session was opened at 09.00 a.m. on Saturday, 10 July 2004, with a warm welcome by Mr Jim Davidson (Australia), Regional Director (Queensland) Australian Bureau of Meteorology.

1.1.3 Speaking on behalf of Mr Michel Jarraud, the Secretary-General of the World Meteorological Organization (WMO), Mrs Nanette Lomarda, the WMO Secretariat representative at the session, expressed the sincere appreciation of WMO to the Government of Australia for hosting the tenth session of the Committee in Brisbane. She stated that the regular sessions of the tropical cyclone regional bodies are convened to enhance the Members' knowledge for self-reliance through pooling of human and financial resources aimed at improving the capacities of the countries concerned. Although RA V/TCC in its nineteen years of existence have already made significant contributions towards upgrading the tropical cyclone forecast and warning services in the region, there are still a number of significant issues which the Committee would like to address in its biennial sessions. Its future programmes hold out positive hope for further improvements which is expected to yield wide-ranging benefits and contribute towards reduction of typhoon damage. She stated further that WMO had always recognized as essential the close interaction between Members and hoped that participants will take full advantage of this year's session to do much needed networking and sharing of in-depth knowledge on tropical cyclone warning issues. Mrs Lomarda assured the session that WMO would continue to support the Committee, to the extent possible, in its effort to attain its humanitarian goals. Finally, she wished the Committee a successful session.

1.1.4 Mr Arona Ngari (Cook Islands), the Vice-president of Regional Association V (South-West Pacific), welcomed the participants to the session and thanked the Government of Australia for hosting the session. He acknowledged the Australian Meteorological and Oceanographic Society (AMOS) for holding the International Conference on Storms that was of relevance to this year's session of the RA V/TCC. He wished the participants a successful session and fruitful deliberations.

1.1.5 Mr Steve Ready, Chairman of RA V/TCC, in his address, emphasized the importance of collaboration in the region and the need for a better understanding of the impact of tropical cyclones in data-sparse regions such as the South Pacific. He encouraged the participants to participate fully and actively in the discussions.

1.1.6 Dr Robert Brook, Deputy Director (Systems and Services) Australian Bureau of Meteorology, welcomed the participants on behalf of Dr Geoff Love, Director of the Bureau. In his welcome address, he reflected on the activities of the Committee through the years focusing on its achievements. He stated that meetings such as this, gives the Members the opportunity to not only contribute to the work of the WMO but also to share experiences with colleagues in the meteorological business. He stressed the crucial contribution of the Members to humanity and the immense value of its work particularly in minimizing the disastrous effects of tropical cyclones. Dr Brook wished the Committee a successful meeting and concluded by formally declaring the session open.

1.1.7 The session was attended by 35 participants from 16 Members of WMO namely: Australia, Cook Islands, Fiji, French Polynesia, Kiribati, Indonesia, Federated States of Micronesia, New Caledonia, New Zealand, Niue, Papua New Guinea, Samoa, Solomon Islands, Tonga, USA and Vanuatu. Also in attendance were the Chairman of RA I/TCC for the South-West Indian Ocean (ex-officio member of this Committee) and three observers from the National Institute of Water and Atmospheric Research (NIWA) and South Pacific Regional Environmental Programme (SPREP). The list of participants in the session as well as the capacities in which they attended is given in **Appendix I.**

1.2 Adoption of the agenda (agenda item 1.2)

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

1.3 Election of vice-chairman (agenda item 1.3)

Mr Sionetasi Pulehetoa (Niue) was unanimously elected as vice-chairman of the tenth session of the Committee.

1.4 Working arrangements for the session (agenda item 1.4)

The Committee agreed that the session be conducted in one committee as a whole, in English with whispered interpretation in French. Small working groups would be established as necessary to consider specific topics to facilitate the work of the session. The Committee also agreed on its working hours with breaks in the morning and afternoon sessions.

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

2.1 The Chairman presented his report on the main activities and progress achieved since its ninth session (Manila, Philippines, 16 to 20 May 2002).

2.2 The Chairman reported to the Committee that:

(a) On April 28th 2004, the Niue Government met with aid donors - NZAID, UNDP and EU to setup a Trust Fund. Apparently, Niue requires about $37.5 million to recover after the ravages of cyclone Heta.

(b) During the space of a week in April 2004, parts of Viti Levu (Fiji) were blitzed by two severe rainstorms resulting in massive flooding, 10 dead and 10 missing. All the deaths occurred during the first storm which was associated with a marginal tropical cyclone. The trackers of tropical "storms" can't afford to drop their guard even for marginal systems as lives are always at stake.

(c) Due to the incident during the dethroning (or declassification) of Grace late on March 23rd 2004 UTC which was challenged by the observations from a large cruise liner whose reports on the 24th suggested there were still gales close enough to the centre, the session will consider the definition for "*Declassifying a tropical cyclone*".

(d) RSMC Nadi, faced with an acute shortage of professional staff has got through the 2003/2004 cyclone season with the help of two expatriate staff. Relocalisation programme is under way but may take several years to implement. He encouraged all Members of the Committee to be cooperative and understanding while RSMC Nadi – Tropical Cyclone Centre goes through the challenges.

(e) During 2003, Tonga hosted the Ninth WMO/SPREP Regional Meteorological Services Directors (9RMSD) meeting in August, and two WMO meetings, the RA V Regional Seminar on Cost Recovery and Administration and the Second RA V Advisory Working Group in December. Tonga is also keen to develop its own forecasting capability in the foreseeable future.

2.3 In addition to the report of the Chairman:

(a) The representative of Niue expressed his thanks to the Government of the United States, in particular to the RSMC Honolulu-Hurricane Center, for the two-month fellowship training provided to one of its staff last year.

(b) In facing the challenge of marginal tropical cyclones, it was noted that forecasters tend to place more emphasis on model information than the observations.

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

3.1 The Committee noted with satisfaction the achievements and progress made in both the general component and the regional component of the TCP since the ninth session of the Committee (Manila, May 2002).

3.2 The Committee was pleased to note further strengthening of close cooperation between the RA I Tropical Cyclone Committee (RA I/TCC) for the South-West Indian Ocean and the RA V Tropical Cyclone Committee (RA V/TCC) for the South Pacific and South-East Indian Ocean. It noted with pleasure that the Bureau of Meteorology, through Mr Gary Foley, Regional Director (Western Australia), would continue active cooperation with the RA I/TCC and the RSMC La Réunion - Tropical Cyclone Centre. The Committee acknowledged with thanks the presence of Mr S.N. Sok Appadu (Mauritius), Chairman of the RA I/TCC, at this session.

3.3 The Committee was informed that the TCP had engaged the services of Systems Engineering Australia Pty. Ltd. in July 2003 to undertake reviews and assessments that would lead to suitable conversion factors between the WMO 10-minute average wind and 1-minute, 2-minute and 3-minute "sustained" winds. The draft report was submitted to WMO on June 2004 and is currently under review by a working group composed of the Directors of TC RSMC La Réunion and Miami and TCWC Brisbane. The technical report from this study will be subsequently included in the updated edition of the Global Guide to Tropical Cyclone Forecasting and the Operational Plans/Manual of the five tropical cyclone regional bodies.

3.4 The Committee urged Members to make full use of recently published technical reports in the TCP series, such as the updated brochure "*Specialized Centres Provide Up-to-Date Tropical Cyclone, Hurricane, Typhoon Advisories*" (WMO/TD-No. 1045) (TCP-44) and the "*Annual Summary of Global Tropical Cyclone Season 2002*" (WMO/TD-No. 1194) (TCP-49).

3.5 The Committee was informed that an expert meeting on the implementation of TCP sub-project no. 23: *Combined effects of storm surges/wind waves and river floods in low-lying areas* was held in Brisbane, Australia on 6 July 2004 and was Chaired by Mr Jim Davidson (Australia). Another experts meeting, this time on the formulation of TCP Sub-project No. 24: *Establishment of a tropical cyclone forecaster Web site* was held on 8 July 2004 also in Brisbane and Chaired by Mr Charles Guard (USA). The Committee noted that the two sub-projects will involve the participation of all five tropical cyclone regional bodies.

3.6 The Committee was informed that plans are underway to conduct the Sixth Southern Hemisphere Training Course on Tropical Cyclones in Melbourne, to be organized by the Australian Bureau of Meteorology in cooperation with WMO, tentatively in May 2005.

3.7 The Committee was informed that the TCP had, as was proposed by the ESCAP/WMO Typhoon Committee, engaged the services of a consultant from the Philippines to undertake a study on the economic and societal impacts of tropical cyclones on the Philippines. The report which is scheduled to be finished by February 2005 will serve as a prototype for subsequent studies that will be conducted in the four remaining tropical cyclone regional bodies. This study is being undertaken in connection with TCP Sub-project No. 25: *Study on the economic and societal impacts of tropical cyclones* that was endorsed by Congress XIV (Geneva, 2003). It was noted that the RA V area has a great deal of expertise in this area as shown by the many presentations on the subject during the International Conference on Storms held in Brisbane, Australia from 5 to 9 July 2004. It was recommended that experts from RA V in this subject area, especially Linda Anderson-Berry from the Australia Bureau of Meteorology, be involved in the project as participants and as reviewers for Sub-project No. 25.

3.8 The Committee noted with pleasure that the Tropical Cyclone Programme (TCP) page on the WMO Web site http://www.wmo.int/web/www/TCP/TCP-home.html was frequently being updated.

3.9 The Tropical Cyclone Programme is extremely important to all of the RA V/TCC Members and to many Members of WMO in the tropical regions who suffer devastating effects of tropical cyclones, some to the extent of threatening a country's viability. Therefore, the Committee strongly urged the Secretary-General to continue to provide adequate human, management and other resources and to further enhance the activities of the programme in order to meet the requirements of the Members of all the tropical cyclone regional bodies.

3.10 The Committee strongly recommended that WMO recognize and bestow an award to Mr Vernon F. Dvorak for his invaluable contribution to the massive reduction of loss of life from tropical cyclones (see **Appendix III** for full text of the Committee's recommendation). The Committee further encourages the other tropical cyclone regional bodies to endorse this recommendation and to put forth a similar recommendation to WMO. Since Mr Dvorak is aging and is experiencing failing health, it was further requested that this recommendation be given a high priority.

3.11 The Committee recognizes that the Japan Meteorological Agency (JMA) runs a global NWP model and was informed that typhoon forecasts of nine Numerical Weather Prediction (NWP) centres are now posted in their Web site and that they would shortly provide the ensemble mean of these forecasts. In this regard, the Committee recommended that a request be made to the JMA that real-time track forecasts for tropical cyclones be provided for the Southern Hemisphere, particularly the South Pacific Ocean. This would be a valuable addition to the limited suite of NWP-based TC track products available to the SW Pacific Nations that can be used for more effective ensemble-type forecasting techniques.

3.12 The Committee requested that basic methods on tropical cyclone forecasting should be in the course programme of training courses on tropical cyclones as not many weather services in the region are equipped with sophisticated equipment which could handle advance forecasting techniques.

3.13 The Chairman of RA I/TCC for the South-West Indian Ocean expressed his thanks to the RA V/TCC and to the Australian Government for Dr Gary Foley's participation at the sixteenth session of the RA I/TCC (Maputo, September 2003). Aside from delivering a technical presentation, Dr Foley actively participated in the deliberations during the session.

3.14 The Committee wishes to thank the South Pacific Regional Environmental Programme (SPREP) for the part it continues to play in maintaining the close working relationship with WMO.

3.15 The Committee recalled that during the eighth session of the Committee (Rarotonga, Cook Islands, September 2000) Mr Jacki Pilon (French Polynesia) requested WMO for a French translation of the publication "A Scale Relating Tropical Cyclone Wind Speed to Potential Damage For The Tropical Pacific Ocean Region: A User's Manual" by Messrs Charles Guard and Mark Lander. The Committee was therefore gratified to know that WMO will be providing funding for the publication to be translated to French and with permission from the authors will re-print copies of the English version for distribution to the RA V/TCC Members. The Committee further expressed its thanks to the authors for providing WMO the publication to be translated and re-printed.

3.16 Given that flash flooding was still a major cause of disasters and loss of lives in the region and that it was noted that there is a general lack of guidance material for such short-term events, the Committee recommended that WMO consider the establishment of a sub-project under the TCP for the preparation of a guide to flash flood forecasting and warning as early as possible.

4. REVIEW OF THE 2002/2003 AND 2003/2004 CYCLONE SEASONS (Agenda item 4)

4.1 The Committee was informed that during the 2002/2003 cyclone season, eighteen (18) tropical cyclones (TCs) formed in the area from the South-East Indian Ocean across northern Australia to the South Pacific with 50% occurring in the normally busy months of January, February and March (refer to Table 1 in Appendix IV). Perth named four (Fiona Graham, Harriet, Inigo), Darwin one (Craig), Brisbane one (Erica), Nadi nine (Yolande, Zoe, Ami, Beni, Cilla, Dovi, Eseta, Fili and Gina) and Papua New Guinea one (Epi). There were also two other unnamed disturbances one in Darwin's area and the other in Perth's which were reclassified after the fact. There were no cyclones in October, November and May. There were two in December, five in January, four in both February and March, two in April and two in June. It was noted that an extra one when counting cyclone activity by month as Beni occurred in both January and February (Refer to Table 1). It is unusual for true tropical cyclones to form in June, but it was recalled that Keli affected southern Tuvalu back in 1997.

4.2 During the 2003/2004 cyclone season, there were thirteen (13) tropical cyclones across the WMO RA V area south of the Equator (refer to Table 2). The life cycle of Linda and Monty spanned parts of January/February and February/March. Hence, a total of 15 when counting cyclones by the month. Like the 2002/2003 season, there were no cyclones in October and November. Heta was the most devastating of the seven cyclones that passed close by. Heta passed close enough to Samoa and caused major damage to crops and buildings but its worst impact was on Niue on January 6th UTC (5th local time) when violent winds combined with a large surge and towering waves climbed up and over the 20- 30 metre cliffs to inflict extensive damage to crops and infrastructure with the loss of two lives. Ivy, although not-as-severe-as-Heta hurricane cut a path through Vanuatu during the 25 to 27 February UTC including a direct hit over Efate (Port Vila) with significant damage and one death. Both Monty and Fay made landfall as significant hurricanes along the coast of Western Australia near Mardie and just northeast of Port Hedland respectively. Debbie came ashore as a marginal hurricane over the Top End coast of Australia. The Perth TCWC was responsible for naming Jana, Ken, Linda, Monty, Nicky (also Helma) and Oscar (also Itseng) while Darwin TCWC named Debbie, Evan and Fay. Brisbane TCWC baptised Fritz and Grace while Nadi RSMC named Heta and Ivy.

4.3 The representative of RSMC Nadi presented the comprehensive reports on the 2002/2003 and the 2003/2004 tropical cyclone seasons. These reports including tables are given in **Appendix IV.**

4.4 The Committee noted the following operational issues and recommendations in the RSMC Nadi report:

Operational issues:

- Fragile communication (Zoe, Heta).
- NMSs and public queries (Samoa/America Samoa)
- Availability of reliable, quality synoptic observations
- Ship reports (see para. 2.2 (c))
- Satellite-derived observations/products & formal training
- Damage Assessment returns
- Future of GOES-9
- High-resolution Wave Model

Recommendations:

- Reliable, affordable and sustainable communications systems must be identified, acquired and installed immediately.

- Synoptic observational network of the region must be thoroughly reviewed and upgraded to meet required standards and demands.

- Formal training for forecasters on scatterometry and other satellite-derived observations and products should be conducted as soon as possible. High-resolution wave model for operational forecasting and warning services for the region should be acquired soonest. A start would be a collective support for Australia's Commonwealth Scientific and Industrial Research Organization (CSIRO) to include wave model in their current 3rd Phase of the Sea Level Rise Project.

4.5 The representative of Australia made a presentation on the cyclones affecting their region during the 2002/2003 and 2003/2004 cyclone season. His report included a brief overview of the Darwin Tropical Cyclone Advisory Centre, SSM/I – TRMM – AMSR-E, five-year programme to modernise radar network, major intensity errors in global NWP predictions, 24 hour forecast RMS error down to 132km, TC Module now used for NWP consensus tracks, TC forecast graphic to be introduced in 2004-2005 and three TC core competency modules being developed - genesis, Dvorak analysis & storm surge/waves.

4.6 The representative of Cook Islands informed the Committee that although no cyclone affected his country during the intersessional period, TC Dovi passed through its waters in its early stages before moving close to Niue and then further south. No special weather bulletin was issued for this cyclone. Heta caused some damage to Southern Cooks with ample warning given by NMS. No Severe Weather Bulletin was issued by RSMC Nadi.

4.7 The representative of Indonesia made a brief presentation on Cyclone Inigo, that did not directly affect but had an impact on the weather in the Province of Nusa Tenggara bordering the South-East Indian ocean, during the 2002/2003 cyclone season (early April 2003). The most affected areas were five districts in the island of Sumba and Flores island. It was reported that Inigo brought widespread rainfall over all parts of the province, and rough sea was observed in the coastal area. The damage statistics: 58 death, 102 injured, 254 houses damage/ structurally damaged, 12 traditional sailing boat sinking, inter island ferry trip was cancelled on 1 April 2003, caused by river flood and land slides. No special warning was issued in association with the cyclone. Local forecaster from Kupang Met Office issued regular weather forecast which was faxed to officials of the local government, to the Provincial Disaster Management Office, and to the local media.

4.8 The representative of the Federated States of Micronesia informed the Committee that there were two TCs in 2002, Chataan and Pongsona. Chataan wreaked havoc on the state of Chuuk in the early hours on 1 July 2002 with great impacts due to heavy rainfall, 500 mm in twenty hours. Landslides (over 100 sites, including incipient slides, according to the US Geological Survey) claimed forty-one (41) lives, seriously injured over 170 people, and destroyed about 300 homes. Strong winds were experienced although not significant in light of the landslides induced by the torrential rains. Pongsona occurred late in the year, in December, with strong winds and minimal damage to a few homes in both Chuuk and Pohnpei. The 2003 TC season was similarly uneventful with only two TCs with similarly lasting impressions on Pohnpei and Yap States. Kujira in the Pohnpei territory claimed one (1) life, as strong winds felled trees in many locations. Lupit caused US$1.7Million in damages in the Yap outer atolls, which required the assistance of the US Federal Emergency Management Agency (FEMA). The 2004 season, which is still open, has had two TCs, both in the Yap region, which required emergency declarations by the governor. Sudal, which made landfall late on the night of 8 April 2004 and lingered in the area for twelve hours through to the early morning on 9 April, caused damages in infrastructure as well as to the environment. FEMA was called on for relief and recovery assistance. (Damages were estimated at USD 12 million). A success indication of the TCOP is the amazing fact that there was no loss of life, despite six hours of up to 180 km/hr of very high winds and nearly twelve hours of winds in excess of 100 km/hr. Six weeks after Sudal, TC Omais provided a scare, but that was all, as it passed out of the Yap region, without much effect.

4.9 The representative of New Caledonia informed the Committee that the 2002/2003 cyclone season was striking in more than one regard. The first striking element is the high number of cyclones (4) compared to the usual number affecting the area. The second is the passage of Zoe, an exceptionally intense cyclone, into the warning zone, even though there was no direct threat to the territory. However, the devastation caused by Cyclone Erica is the one that will stay in their memories for some considerable time to come. Finally, the late arrival of Gina during the month of June close to the northern part of La Grande Terre did not cause any damage. On the other hand, the 2003/2004 cyclone season was quiet with only two tropical cyclone events that caused only minor damage.

4.10 The representative of New Zealand informed the Committee that during the 2002/2003 cyclone season, seven out of the 11 tropical cyclones that formed in the Coral Sea and South Pacific crossed 25°South into the Wellington area of responsibility. Ami, Erica and Eseta were all hurricanes when they arrived while Dovi and Fili came with storm and gale intensity respectively. All of them had been downgraded by the time they reached 30°South. Although the remains of Yolande and Zoe crossed 25°South, they were no longer tropical cyclones. None of the cyclones posed a threat to any land area as they spent the extratropical part of their lives over the open ocean. During the 2003/2004 cyclone season, two out of the four tropical cyclones that formed in the Coral Sea and South Pacific crossed 25°South into the Wellington area of responsibility. Although Ivy passed close to the northeast of the North Island, it was quite mobile so the most damaging winds would have occurred offshore of New Zealand in the cyclone's northeastern semicircle where the movement and circulation vectors worked in tandem. On the other hand, Heta spent its life in the Wellington area harmlessly over the open sea.

4.11 The representative of Niue presented a report on the effects of Typhoon Dovi (2002/2003 cyclone season) and TC Heta (2003/2004) on the country. He focused on the extensive damage of Heta on the island and the lessons learned during the event. He expressed appreciation to RSMC Nadi-TCC, TCWC Brisbane, TCWC Wellington, the Governments of Australia, New Zealand and the United States for their valuable assistance during and after the cyclone event.

4.12 The representative of Papua New Guinea presented a report of TC Epi. His report included a post analysis, time scale analysis, latitudinal temperature profile, temperature profile and histogram of the cyclone. Epi was a short-lived cyclone. The affected areas are within the Solomon Sea and the eastern Milne Bay Islands Waters. Some flooding did occur within the affected region but no damage reports have been received so far.

4.13 The representative of Samoa informed the Committee that the only event of any significant magnitude during the season apart from several synoptic scale tropical depressions which brought heavy rainfall, was TC Heta that made entry into their area on 1st January 2004. He expressed appreciation to NOAA's Honolulu Weather Office, Pago Pago Weather Service, RSMC Nadi and Samoa's Meteorological Service for the formulation and subsequent testing of Samoa's new warning procedures. This procedure was put to the test during the occurrence of Heta and despite some technical communication problems experienced, the test was successful and resulted in a more improved warning system.

4.14 The representative of American Samoa made a brief presentation on the damaging effects of TC Heta to the Islands. Heta was a category five hurricane which moved within 120 miles of American Samoa on January 4 and 5, 2004, affecting the territory with hurricane force winds and very destructive surf.

4.15 The representative of Solomon Islands reported that during the 2002/2003 cyclone season two major cyclones devastated the southern parts of Solomon Islands, namely TC Zoe, the strongest system ever recorded in this region since the use of satellite imagery for monitoring purposes and TC Beni. The warnings for the two cyclones were disseminated using the facilities of the Civil Aviation and the National Disaster Management Office's facilities, otherwise the situation would have been catastrophic for the Solomons. In the case of Zoe, the weather service knew only of the system when the national radio broadcasted the initial advisory following an arrangement made with the TCWC in Brisbane. Otherwise there would be total chaos. The 2003/2004 cyclone season was very quiet except for a few tropical lows developing in the vicinity of the country, one of these lows later developed into TC Ivy which affected Vanuatu and another developed into a rain depression that went through Fiji in April which caused a lot of flooding and deaths.

4.16 The representative of Tonga informed the Committee that the last two seasons has been one of the most active seasons especially during the early part of 2003. Since 1960, the 2002/2003 seasons has been second only to the 1992/1993 season in terms of the number of cyclones affecting the country. During the 2003/2004 cyclone season, although quiet compared to the 2002/2003 season, Tonga, in particular the island of Keppel, was significantly damaged by TC Heta. A number of houses were blown away and crops were destroyed. Fortunately, no lives were lost. Recognizing the importance of attachment trainings to the development of the Tonga Meteorological Service, in particular on tropical cyclone operations, he requested attachment of their forecasters at the RSMC Nadi preferably during the cyclone season.

4.17 The representative of Vanuatu informed the Committee that the 2002/2003 tropical cyclone season has been more active compared to previous years, with more cyclones and some with notably very high intensity and long duration. The cyclones that affected Vanuatu were Zoe, Beni and Gina. The 2003/2004 tropical cyclone season was relatively quiet compared to the previous season. There was only one cyclone that affected Vanuatu and that is TC Ivy. The cyclones of the 2002/2003 season caused no substantial damage but Ivy during the 2003/2004 season inflicted a significant amount of damage to the islands from the northern parts of Torba Province right through the island of Aneityum. The areas, which were severely affected by the might of TC Ivy, were Penama, Malampa, Shefa and Tafea Province.

4.18 The representative of USA made a presentation on the 2002/2003 cyclone season, TC Heta, operational activities of the Joint Typhoon Warning Centre (JTWC) and the services it provides.

4.19 The Chairman of RA I/TCC expressed his concern about the prevalence of tropical cyclone information other than from the official national weather service which can be the cause of public confusion. To prevent such occurrences, he requested that those providing such information, include a proviso that these data can not be re-distributed to the public especially through the media without prior permission from the official source. He further requested that it include a reference to TC RSMCs, TCWCs and NMHSs as the official source of tropical cyclone advisories and warning information.

4.20 The reports and powerpoint presentations on the 2002/2003 and 2003/2004 cyclone seasons provided by Member countries are given in **Appendix V**.

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

5.1 The Committee examined in detail and discussed in-depth the proposed changes to the text of the Tropical Cyclone Operational Plan for the South Pacific and South-East Indian Ocean. It took into account experiences gained during the past cyclone seasons; implementation of items in the Committee's Technical Plan; and other relevant changes during the inter-session.

5.2 The Committee discussed at length the following terminology in the operational plan

and finally agreed to a change in definitions as follows:
Tropical Disturbance - A non-frontal system of synoptic scale originating over the tropics with persistent enhanced convection and/or some indications of cyclonic wind circulation.

Tropical Depression = Tropical Low - A tropical disturbance with a clearly defined cyclonic wind circulation in which the central position can be estimated, and a maximum 10-minute average wind speed of less than 34 knots (63 km per hour ie gale force) near the centre. There may be gale force or stronger winds in one or more quadrants but not near the centre.

Monsoon Trough- A shear zone with westerly monsoon winds on the equatorial side and easterly trade winds on the poleward side.

Monsoon Depression = Monsoon Low - A tropical depression (or tropical low) embedded in the monsoon trough.

Tropical Cyclone - A non-frontal low pressure system of synoptic scale developing over warm waters and having a definite organised wind circulation with a maximum 10-minute average wind speed of 34 knots (63 km per hour ie gale force) or greater near the centre.

Naming a Tropical Cyclone - A non-frontal low pressure system of synoptic scale developing over warm waters will be named whenever observations and/or Dvorak intensity analysis indicate the presence of gale force or stronger winds near the centre which are likely to continue.

Declassifying a Tropical Cyclone - A tropical cyclone will be declassified whenever observations and/or Dvorak intensity analysis indicate that the system has less than gale force winds near the centre or the system has transformed into an extra-tropical cyclone structure.

5.3 The Committee will seek the approval of the President of RA V for the amendments to the text of the Operational Plan.

5.4 The Committee requested the Secretary-General of WMO to publish a new edition of the Tropical Cyclone Operational Plan in English and French versions as a WMO Technical Document (WMO/TD-No. 292) in the TCP series (TCP Report No. TCP-24), as soon as possible.

5.5 A sub-committee was formed to undertake a comprehensive review of the TCP-24 between the 10th and 11th sessions. This group consists of Jim Davidson (Australia), Jim Weyman (USA), Rod Stainer (New Zealand), Yuriy Kuleshov (Australia), Steve Ready (New Zealand), Rajendra Prasad (Fiji), Benoît Broucke (New Caledonia) and Alipate Waqaicelua (Fiji). A draft plan should be completed before the TC RSMCs and TCWCs Technical Coordination Meeting scheduled for late 2005.

5.6 New Zealand accepted Australia's generous offer for Brisbane Tropical Cyclone Warning Centre (TCWC) to provide a temporary operational back-up to Wellington TCWC.

5.7 Also, New Zealand reconfirmed its commitment for Wellington TCWC to provide temporary operational back-up for RSMC Nadi in accordance with the responsibility outlined in Chapter 2 of TCP-24.

6. FORMULATION OF THE TECHNICAL PLAN AND ITS IMPLEMENTATION PROGRAMME (2004–2006) (Agenda item 6)

(a) Under this agenda item, the Committee established a working group under the chairmanship of Mr Jim Davidson (Australia) to carry out, during the session, formulation of a new Technical Plan for future development of services for the period 2004 to 2006. On 14 July, the working group submitted to the Committee the draft Plan which was subsequently approved by the Committee and reproduced in

Appendix VI.

(b) The Committee carried out a wide-ranging review of the developments and activities under the five components. A summary of the discussions, and the main conclusions and proposals, some also reflected in the Plan are given below.

6.1 Meteorological component (agenda item 6.1)

Meteorological Observing System

6.1.1 As regards meteorological observations, the Committee noted the information provided on the status of implementation of the regional basic synoptic networks of surface and upper-air stations as well as on the relevant results of the monitoring of the operation of the WWW system. The Committee was informed that the current Regional Basic Synoptic Network (RBSN) in Region V, is comprised of 345 surface based stations and 73 TEMP reporting stations.

6.1.2 The Committee noted that the availability of SYNOP reports from some areas of the region was not satisfactory during the April 2004 Special MTN Monitoring (SMM) exercise wherein no SYNOP reports were received from East Timor, Nauru, Tokelau and Swains Islands and no TEMP reports were received from Solomon Islands, Nauru and Vanuatu.

6.1.3 The Committee noted the unsatisfactory results during the monitoring exercise mentioned above and urged Members to take appropriate measures to ensure that the Region attains better monitoring results in the future.

Marine observations

6.1.4 The Committee noted that because major ship routes of merchant vessels do not cover most part of RA V, there are fewer marine meteorological data by Voluntary Observing Ships (VOS) for the region than other regions. The number of ship reports remains fairly constant from one year to another, but buoy reports continue to increase. Thanks to the activities of the Global Drifter Programme (GDP) and International Buoy Programme for the Indian Ocean (IBPIO), many of the previous simple oceanographic drifters in the region also make meteorological measurements.

6.1.5 The Committee was informed that the South East Asian Centre for Atmospheric and Marine Prediction (SEACAMP) project, which has been formally adopted by the ASEAN Sub-Committee on Meteorology and Geophysics, has now entered its implementation phase, coordinated by the Meteorological Service Singapore, which has established a project Web site. This site is so far available only to project participants, but will eventually be opened to the public.

Meteorological satellites

6.1.6 The Committee was informed that the space-based component of the Global Observing System (GOS) is now comprised by satellites of three types: operational meteorological polar-orbiting, and operational geostationary satellites and environmental R&D satellites. It was also informed that in recognition of the critical importance for data, product and services provided by the WWW's expanded space-based component of the GOS to WMO Programmes and supported Programmes, and that such importance would continue to expand rapidly, the Fourteenth WMO Congress decided to initiate the WMO Space Programme as a major crosscutting Programme to increase the effectiveness and contributions from satellite systems to WMO Programmes.

6.1.7 The Committee noted with appreciation the latest detailed information on geostationary, polar-orbiting and R&D meteorological satellites, applicable for the Pacific region, as given in **Appendix VII.**

6.1.8 The Committee was informed of NASA's plan to terminate the Tropical Rainfall Measuring Mission (TRMM). The Committee noted that data from TRMM are used routinely in tropical cyclone monitoring and forecasting in many countries in RA V, and by RSMCs and TCWCs in particular. Data from TRMM assist in identifying the centres of tropical cyclones and other structural information (such as eye diameter, estimates of the radius of maximum winds) when the eye is observed with cirrus clouds. TRMM data are particularly valuable at night. TRMM data have many advantages over other microwave sensing instruments, such as higher spatial resolution, real-time calibration and more direct measurement of rainfall rates. Noting the value of TRMM data for the high priority task of TC forecasting in the context of disaster mitigation, the Committee requests the Secretary-General of WMO to:

- Inform the Coordination Group on Meteorological Satellites (CGMS) of the great value TRMM data are providing to operational TC forecasting; and

- Use whatever avenues are available to request that NASA reconsider the decision to terminate the TRMM mission while the satellite is still functioning.

6.2 Hydrological component (agenda item 6.2)

RA V Working Group on Hydrology

6.2.1 The Committee was informed that the regional aspects of WMO's Hydrology and Water Resources Programme are carried out by the RA V Working Group on Hydrology (WGH), re-established by the thirteenth session of RA V (Resolution 14 (XIII-RA V)).

6.2.2 The Chairman of the RA V WHG is Mr Rishi Raj (Fiji) and as a follow-up of the work of the working group, a meeting was held in Wellington, New Zealand in February 2002. The two major outputs have been:

(a) A Programme to meet Hydrological Training Needs of Small Island Countries in the Pacific; and

(b) A Pacific HYCOS Proposal document.

Both of these documents were written by Mr Paul Mosley (New Zealand) with assistance from Mr Rishi Raj and the members of the RA V WGH.

6.2.3 Also during the said meeting, the RA V WGH identified the following topics as being of relevance for its future Work Programme:

- Hydrological Training (basically the Training Programme identified above)
- Technology and Data Standards
- Hydrological Network Maintenance Support
- Integrated Water Resources Management
- Public Awareness of the Value of Hydrological Data and Products
- Climate Variability and Change (including ENSO)
- Regional Information and Communication System
- Numerical Weather Products for Operational Hydrology
- Application of HOMS
- Linkages with the RA II/RA V Typhoon/Tropical Cyclone Committees

6.3 Disaster prevention and preparedness component (agenda item 6.3)

6.3.1 The Committee noted that the EC-LVI has approved the implementation plan of the new major programme Natural Disaster Prevention and Mitigation Programme (NDPM) and has adopted an EC Advisory Group on Disaster Prevention and Mitigation to oversee the new programme and to coordinate its activities with the Public Weather Services Programme and

the other WMO programmes with relevant activities in the area of disaster risk reduction.
6.3.2 The Committee noted that taking in account the different regional and national characteristics and vulnerabilities, the new programme will establish a network of national focal points and groups of experts at regional level. Those will promote the exchange of information and will assist the NMHSs to identify their priorities and to build capacity in natural disaster prevention and mitigation at national and regional level. The meeting recognized the need to establish mechanisms of communication and collaboration with the national focal points and the RA V regional expert group.

6.3.3 The Committee recognized the importance of the implementation of a Disaster Information System and the establishment of an Inventory of Relevant Best Practices and agreed to collaborate namely with the identification and exchange of information on current best practices in policy and activities related with natural disaster prevention and mitigation in the area of their competence.

6.3.4 The Committee noted that the Natural Disaster Prevention and Mitigation Programme Web page can already be found in an experimental phase at the following address: http://www.wmo.int/disasters for comments and suggestions. It urged its members to provide relevant information of its activities to the Secretariat to be included in the Web page in order to ensure that this page will become a reference page for the disaster risk management community.

6.3.5 The Committee was informed on the developments in the preparation of the World Conference on Disaster Reduction (WCDR) to be held in Kobe, Hyogo, Japan, 18 to 22 January 2005, namely on the organizational aspects, position paper of WMO and its activities in preparation for the Conference. In connection with the preparation of the Conference, it was stressed that it is necessary for NMHSs to make input through the national channels to PrepCom II coming up in Geneva in October 2004. The Committee stressed the need of the NMHSs to be recognized as an essential part of national infrastructure on disaster risk reduction and urged Members to make efforts in ensuring that NMHSs representatives are part of national delegations to the Conference and to work closely with relevant national committees on disaster reduction, particularly those coordinating national positions required by the Conference Secretariat as vital input to a successful event in Kobe, Hyogo, Japan.

6.3.6 With respect to possible participation in the World Conference on Disaster Reduction (WCDR) in Kobe in 2005, the Committee suggested to highlight the regional experiences on the implementation of the DPP components and the importance to mobilize commitment of all key stakeholders, especially the political, technical and financing parties, to the implementation mechanism on DPP. In this connection, the Committee identified the opportunity to link this subject to the ongoing efforts of the International Strategy for Disaster Reduction (ISDR) regarding the platform on early warnings. The Committee also discussed the need to ensure substantial achievements on capacity building and suggested to identify clear priority of the training focus so as to facilitate mobilization of support to the work of the Committee at the WCDR.

6.3.7 In preparation for the WCDR, Mr Joe Barr, a consultant for SOPAC interviewed the Chairman and some RA V/TCC Members about the work of the Committee over the past decade for inclusion in a regional report to be presented at the WCDR.

6.3.8 As requested in EC-LVI (Document 11), the Committee strongly recommended the organization of a side event at the forthcoming WCDR for communication initiative and methods, such as RANET (RAdio and InterNET).

6.4 Training component (agenda item 6.4)

6.4.1 The Committee was pleased to note the involvement of its Members in the major education and training activities of WMO that have taken place since its last session.

6.4.2 The Committee expressed appreciation for the number of training events that were organized by WMO and Member countries during 2003, especially those events that were of direct relevance to tropical cyclones, which were considered of great value in stimulating and assisting in further development of tropical cyclone activities.

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

6.4.4 The Committee noted that WMO continued to assist the WMO RMTC located in the Philippines to improve its training programmes by provision of financial support to purchase textbooks and to staff members for attending specialized training courses and scientific events abroad. The Committee urged its Members to make maximum use of the courses offered by this Centre in meeting the training requirements that cannot be met nationally. It also requested its Members to consider ways and means of assisting the RMTC in organizing regular and specialized courses of interest to the Committee's activities, using such ways and means as the provision of instructors for short-term assignments, provision of relevant training materials and teaching aids through bilateral and multilateral arrangements.

6.4.5 The Committee noted with satisfaction the information on the activities of the WMO Training Library and the use made of its services by the Members. It also appreciated the continuous updating of the Virtual Training Library (VTL) in an effort to provide the latest and most suitable available training material through Internet and recommended that those actions should be encouraged and continued.

6.4.6 The Committee noted that WMO fellowships remain crucial in assisting Member countries in the fields of capacity building, in particular the emerging new needs such as satellite meteorology, information technology, new telecommunication systems, computer technology, modern data processing systems, climate change, natural disasters and the atmospheric environment. It noted with satisfaction the efforts being made to further enhance the Programme and to improve effectiveness and transparency in the granting and implementation process of fellowships. The Committee thanked the Secretary-General for the circular letter sent to the Permanent Representatives of Member countries regarding requests for fellowships and urged its Members to utilize more effectively the Fellowships Programme.

6.4.7 The Committee expressed its thanks to the Government of the USA for the two-month training course for forecasters at the Pacific Desk in the US National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) Honolulu Office. The Committee requested the continuation of said course.

6.4.8 The Committee was gratified with the information that the Sixth Southern Hemisphere Training Course on Tropical Cyclones, will be organized by the Bureau of Meteorology in collaboration with WMO sometime early next year. The Committee expressed its gratitude to Australia and WMO for the organization of the course and requested them to make every effort to organize future courses in this series.

6.4.9 The Committee also expressed its appreciation to the Australian Bureau of Meteorology for the in-country mentor training provided by the Bureau to Papua New Guinea in 2003. The Committee therefore requested that this activity be continued.

6.4.10 The Committee noted that since most Members of the Committee would benefit from in-country mentor training during a tropical cyclone monitoring episode it requested, through the representative of Australia, the Director of the Australian Bureau of Meteorology to provide suitable trainers for this task.

6.4.11 The Committee was pleased to know that RSMC Nadi and TCWC Brisbane will accept forecasters from Members of the RA V/TCC for training attachment during the intercessional period.

6.4.12 The Committee requested WMO to organize a workshop on storm surges and wind waves in 2005.

6.4.13 The Committee was pleased to learn that RSMC Nadi had been assisting island countries with their training needs through the Third Country Training Programme of the Japan International Cooperation Agency (JICA). Over 30 meteorological personnel from the region had received training so far with 20 more to be trained during the 2004/2005 period. It thanked the Government of Japan for its kind assistance and was hopeful that the programme would continue into the foreseeable future.

6.5 Research Component (agenda item 6.5)

6.5.1 The Committee noted with satisfaction that the Fifth WMO International Workshop on Tropical Cyclones (IWTC-V) was successfully held in Cairns, Australia from 3 to 12 December 2002 with Professor Russell L. Elsberry (USA) as the chairman of the International Committee (IC). The Committee was also pleased that it was well represented at the workshop.

6.5.2 The Committee also noted that copies of the final report of IWTC-V have already been distributed to the Members and that the report contains very important and useful recommendations separately addressed to WMO, the research community and the tropical cyclone operational scientists. The Committee urged its Members and all concerned to endeavour to implement the recommendations relevant to their activities. The Committee was particularly pleased that part of the recommendations of the workshop concerns proposals for the revision of the publication “Global Guide to Tropical Cyclone Forecasting”. The Committee agreed with the recommendation of IWTC-V that the publication was a valuable forecast reference and strongly supported the recommendation that this guide should undergo an evolutionary revision and be reissued.

6.5.3 The meeting recommended the Director of TC RSMC Nadi to represent the RA V/TCC on the International Committee of IWTC-VI to be held tentatively in late 2006, possibly in Costa Rica.

6.5.4 The Committee noted that at the initiative of Canada and co-sponsorship of WMO, the Second International Workshop on Extra-tropical Transition of Tropical Cyclones (IWET-II) was held in Halifax, Canada from 15 to 21 November 2003. The Committee was pleased that some of its Members participated in the workshop. The Committee requested that the proceedings of the workshop be distributed to its Members.

6.5.5 The Committee recognized that great challenges existed for improving the prediction of tropical cyclone landfall, and welcomed the organization of an International Workshop on Tropical Cyclone Landfall Processes in 2005, which would contribute to improving further safety and to reducing the economic losses of tropical cyclone affected countries. The Committee urged its Members to participate in and contribute to the workshop.

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

7.1 The Committee was pleased to note that several Members of the Committee continued to benefit from the WMO Voluntary Cooperation Programme (VCP). In 2003-2004, 18 VCP project requests were submitted by nine Members of the Committee: four of them concerned the installation of VSAT ground equipment and International Satellite Communications System (ISCS) workstation for World Area Forecast System (WAFS) data and products, three for replacing/upgrading WAFS ISCS workstation, three related to the improvement of surface observing stations, two for the improvement of upper-air observing network, one for the installation and upgrading of EMWIN system, two related to the improvement of telecommunication facilities, two for climatological data rescue and climate database system, and one for expert services to receive meteorological satellite images. The Committee recommended to the Secretary-General to organize a meeting for LDCs of RA V/TCC in order to start discussions on special issues and to contribute to projects for the rehabilitation and improvement of their basic meteorological and hydrological infrastructure.

7.2 The Committee was informed that five Members received support for a total of seven VCP projects for equipment and services during 2003-2004. It noted though with concern that 34 projects are still awaiting support as of 25 June 2004.

7.3 The Committee was informed that the VCP activities for 2004 will place emphasis on the information and communication in accordance with the 2004 VCP theme, “Technical Cooperation in Weather, Water and Climate – Bridging the Gap in the Information Age”. In connection with the theme for World Meteorological Day 2005, “Weather, Climate, Water and Sustainable Development”, the VCP theme for 2005 would be “Technical Cooperation for Sustainable Development”.

7.4 The Committee noted with appreciation that coordination by the WMO Emergency Assistance Response Team (EART) is underway for the assistance to Cook Islands, Niue, Samoa and Tonga affected by cyclone Heta and to Vanuatu affected by cyclone Ivy. In May 2004, Samoa received financial support from WMO for three staff from its Meteorological Service Division to participate in the Post-Cyclone Coordination Meeting held in Pago Pago, American Samoa.

7.5 It was further pleased to know that following the discussions in the 2003 Informal Planning Meeting on the VCP and related Technical Cooperation Programme (2003 IPM/VCP), the possible support to the Democratic Republic of Timor-Leste was considered by Australia, Indonesia and Portugal in developing its meteorological services. Australia agreed to contribute AU$10,000 to a WMO Trust Fund to enable a fact-finding WMO mission to the Democratic Republic of Timor-Leste in collaboration with Australia, Indonesia and Portugal.

7.6 The Committee was informed that the World Meteorological Congress at its fourteenth session (Geneva, Switzerland, May 2003) decided to established a WMO Programme for the Least Developed Countries (LDCs). Its long-term objective is to contribute efficiently and in a timely manner to the social and economic development of those countries concerned through the enhancement of the capacities and capabilities of the National Meteorological and Hydrological Services (NMHSs). A special WMO Trust Fund for the LDCs had been established for which several countries including Australia had offered cash and in-kind contributions. Specific projects for LDCs will be developed using strategic plans prepared for the rehabilitation and improvement of basic meteorological and hydrological infrastructure in various regions.

7.7 The Committee noted with pleasure that a Global Climate Observing System (GCOS) Cooperation Mechanism was established in October 2003 as a coordinated multi-governmental approach to address the high-priority needs for stable long-term funding for key baseline elements of global observing systems for climate in support of the requirements of the UNFCCC and other GCOS clients and taking into account the special needs and situations of LDCs and Small Island Developing States (SIDS). In this context, a technical support project is being implemented for maintenance and support to Pacific Island Programmes. Under funding from the US Climate Change Research Initiative for the enhancement of global climate atmosphere observing systems, several GCOS Upper-air Network (GUAN) stations of Members are being/will be upgraded within the framework of the VCP.

7.8 The Committee noted with satisfaction that the Regional and Sub-Regional Offices continue to play an active role in supporting technical cooperation activities in the Region in close collaboration with the former Technical Cooperation Department. The new Department known as the Regional Activities and Technical Cooperation for Development (RCD) has been established to ensure the smooth and efficient implementation of activities within the framework of the Regional and Technical Cooperation Programmes.

7.9 The Committee was informed that in response to the request from the delegation of Tonga during the Fourteenth World Meteorological Congress held in May 2003 in Geneva, a WMO consultancy mission to Tonga in the field of meteorology was carried out in July 2003 by Mr R. Prasad (Fiji) and Mr H. Taiki (Sub-Regional Office for the South-West Pacific) to identify the requirements for establishing a Weather Forecasting Office in the Meteorological Service of Tonga and to prepare a project proposal. The project proposal was submitted to the Government of Tonga and was officially endorsed by the government in May 2004.

7.10 The Committee was informed that after the consultation between the UNDP Office in Samoa, the WMO Sub-Regionall Office for the South-West Pacific and the Government of Tokelau, a project proposal for "Strengthening Disaster Management and Preparedness" in Tokelau was formulated with the overall objective to provide an enabling environment for Tokelau through the strengthening of institutional policy frameworks for disaster management and preparedness. The project has been approved by the above three parties in January 2004 and will be implemented in 2004 and 2005.

7.11 The Committee noted Niue's concern on the quality of the data extracted from a privately owned Automatic Weather Station which is currently the only source of meteorological data from the Island. It also noted the immediate observation needs of the Niue weather service. In this regard, it strongly urged WMO to take urgent steps to ensure that the recovery programme for the Niue Meteorological Service, severely damaged by TC Heta, be implemented as soon as possible.

7.12 In order to assist its Members, especially during emergency situations and in the implementation of its technical plan, the Committee discussed the possibility of establishing its own contingency Trust Fund. Furthermore, the Committee agreed that this would also in a small measure ensure the self-sufficiency of the RA V/TCC, and that the details will be worked out by the working group, in consultation with WMO and its Members. The working group consists of Steve Ready (Chairman, RA V/TCC), Ven Tsui (Australia), Rajendra Prasad (Fiji), Nicolas Beriot (New Caledonia) and Jim Weyman (USA).

8. DATE AND PLACE OF THE ELEVENTH SESSION (Agenda item 8)

8.1 The Committee expressed the need to continue its work in the light of Resolution 5 (XIII-RA V). It also expressed the desire that its eleventh session be held before the 2006-2007 cyclone season.

8.2 The delegate of Australia informed the Committee that his country would be privileged to host the eleventh session of the RA V/TCC in 2006, the precise venue and dates to be determined later.

8.3 The Committee, in welcoming the information and accepting with pleasure this offer, expressed its warm appreciation to the Government of Australia. It requested the Secretary-General of WMO to take appropriate action, in consultation with the President of RA V and its Chairman, on the arrangements for the session be held in conjunction with the fourteenth session of Regional Association V.

9. SCIENTIFIC PRESENTATIONS (Agenda item 9*)*

The Session recorded its appreciation to the following presentors:

Dr Yuriy KULESHOV
for his presentation on
"International Cooperation in support of development of the Southern Hemisphere tropical cyclone archive, climatology and seasonal prediction scheme of variables describing the cyclone season".

Mr Charles GUARD
for his presentation on
"A Scale Relating Tropical Cyclone Wind Speed to Potential Damage For The Tropical Pacific Ocean Region"

and for distributing during the session a brochure on "*Are you prepared for a Typhoon*?".

Mr Kelly SPONBERG
for his presentation on
"RANET (RAdio and InterNET) Dissemination and Communication of Environmental Information for Rural Community Development"

Mr Gary CLARKE
for his presentation on
"A Pacific Islands RANET"

Mr Colin SHULTZ
for his presentation on
"RANET: Building Bridges"

10. CLOSURE OF THE SESSION (Agenda item 10)

The report of the tenth session of the Committee was adopted at its final meeting on 15 July 2004.

LIST OF APPENDICES

APPENDIX I

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Vice-chairman	Mr Sionetasi Pulehetoa	(Niue)

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APPENDIX II

AGENDA

1. ORGANIZATION OF THE SESSION

   1.1 Opening of the session
   1.2 Adoption of the agenda
   1.3 Election of the vice-chairman
   1.4 Working arrangements of the session

2. REPORT OF THE CHAIRMAN OF THE COMMITTEE

3. COORDINATION WITHIN THE WMO TROPICAL CYCLONE PROGRAMME

4. REVIEW OF THE 2002-2003 AND 2003-2004 CYCLONE SEASONS

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

6. REVIEW OF THE TECHNICAL PLAN AND ITS IMPLEMENTATION PROGRAMME

7. ASSISTANCE REQUIRED FOR THE IMPLEMENTATION OF THE PROGRAMME FOR THE DEVELOPMENT OF SERVICES

8. DATE AND PLACE OF THE ELEVENTH SESSION

9. SCIENTIFIC PRESENTATIONS

10. CLOSURE OF THE SESSION

APPENDIX III

RECOMMENDATION FOR A WMO AWARD AND RECOGNITION OF THE INVALUABLE ACHIEVEMENTS OF MR VERNON F. DVORAK FOR GREATLY REDUCING THE LOSS OF LIFE FROM TROPICAL CYCLONES

The RA V Tropical Cyclone Committee most strongly recommend that the highest levels of the World Meteorological Organization (WMO) recognize and bestow an award to Mr Vernon F. Dvorak for his invaluable contribution to the massive reduction of loss of life from tropical cyclones.

For more than three decades, the highly unique Dvorak technique has provided reliable, accurate and credible estimates of the intensity of tropical cyclones from meteorological satellite imagery. Before the development of this one-of-a-kind technique, there was no reliable method to determine the intensity of tropical cyclones except through the use of *in situ* reconnaissance aircraft, which was available for only a small portion of the tropical cyclone-prone regions. Despite the quantum leaps in technology over the last 20 years, the Dvorak technique remains the primary tropical cyclone intensity determination technique. Since the technique's inception, there have been more than 125,000 intensity estimates made on some 2,500 tropical cyclones.

Tropical cyclones directly affect nearly 1 billion people in cyclone-prone regions. Prior to the development of the Dvorak technique, tropical cyclone disasters were common with massive numbers of casualties. Since the technique's development, warnings have improved greatly and casualties have diminished commensurately. While many projects and programs have helped to foster this decline in casualties, no single one achievement has had the impact of the Dvorak technique. Although it is not possible to quantify the number of lives saved by the Dvorak technique over the last 30 years, an estimate of several hundreds-of-thousands of lives saved is not unrealistic.

The RA V Tropical Cyclone Committee further encourages the other Tropical Cyclone Bodies to endorse this recommendation and to put forth a similar recommendation to WMO. Since Mr Dvorak is aging and is experiencing failing health, we further request that this recommendation be expedited.

APPENDIX IV

RSMC NADI 2002/2003 AND 2003/2004 CYCLONE SEASON SUMMARY

REVIEW OF THE 2002/2003 CYCLONE SEASON

A summary is presented of tropical cyclone activity during the 2002/2003 cylone 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.

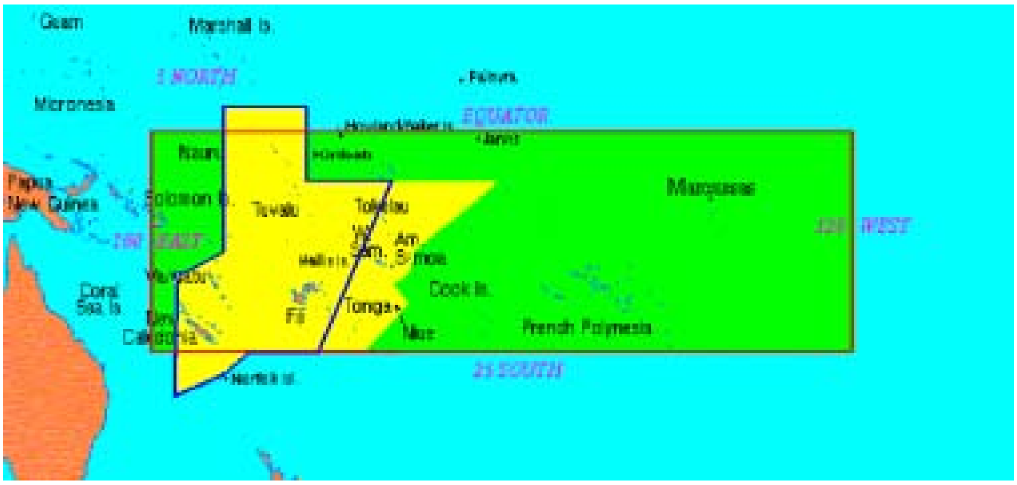


Figure 1: RSMC Nadi Area of Responsibility (rectangle with red boundary and green background). *Area with blue boundary and yellow background is the new re-aligned Nadi FIR*.

Table 1 Tropical Cyclones in the RSMC Nadi area of responsibility in 2002/2003. All dates and times are in UTC[1]. (* - named by TCWC Brisbane)

	Low first identified			*Initial tropical cyclone phase*			
Name	***Date***	***Lat.***	***Long.***	***Date***	***Time***	***Lat.***	***Long.***
Yolande	29 Nov	11.5°S	178.0°E	04 Dec	2255	20.6°S	174.7°W
Zoe	23 Dec	08.0°S	176.0°W	25 Dec	2100	10.8°S	175.5°E
Ami	09 Jan	08.0°S	176.0°W	12 Jan	0000	10.8°S	179.4°W
Beni	19 Jan	08.0°S	170.0°E	25 Jan	0000	13.2°S	161.2°E
Cilla	24 Jan	16.0°S	174.0°E	27 Jan	0000	18.0°S	178.0°W
Dovi	05 Feb	11.0°S	163.0°W	05 Feb	2300	14.0°S	162.7°W
Erica*	01 Mar	21.0°S	147.9°E	04 Mar	0600	20.5°S	154.0°E
Eseta	08 Mar	13.0°S	176.0°E	10 Mar	0600	16.2°S	172.2°E
Fili	13 Apr	13.5°S	178.0°W	14 Apr	1800	20.4°S	171.6°W
Gina	04 Jun	10.5°S	171.0°E	05 Jun	0600	11.3°S	169.1°E

	Maximum Intensity (knots)					*End of Tropical Cyclone Phase*			
Name	***Date***	***Time***	***Lat.***	***Long.***	***Int.***	***Date***	***Time***	***Lat.***	***Long.***
Yolande	05 Dec	0000	21.0°S	173.5°W	35	05 Dec	1200	21.8°S	172.2°W
Zoe	28 Dec	0600	12.5°S	169.5°E	130	01 Jan	0000	20.2°S	175.0°E
Ami	14 Jan	1200	23.1°S	176.2°W	80	15 Jan	1200	29.1°S	163.3°W
Beni	29 Jan	1200	17.7°S	164.7°E	110	31 Jan	1800	24.3°S	163.5°E
Cilla	29 Jan	0000	22.3°S	167.5°W	40	29 Jan	1200	22.5°S	166.0°W
Dovi	09 Feb	0000	20.2°S	168.5°W	110	11 Feb	0000	26.0°S	169.0°W
Erica*	13 Mar	1200	20.6°S	162.7E	115	15 Mar	1200	30.0°S	179.0°E
Eseta	13 Mar	0600	22.2°S	175.3°W	100	14 Mar	1200	31.0°S	160.0°W
Fili	15 Apr	0600	28.0°S	170.0°W	50	15 Apr	1200	29.4°S	170.6°W
Gina	07 Jun	1800	17.2°S	161.8°E	80	09 Jun	0600	16.5°S	162.0°E

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

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. *Yolande* could not be verified at all while *Fili* could not be verified beyond 0 hours, due to insufficient data.

Lead-time	***0 hours***		***12 hours***		***24 hours***	
Name	***Mean error (km)***	***Number***	***Mean error (km)***	***Number***	***Mean error (km)***	***Number***
Yolande	-	-	-	-	-	-
Zoe	13	26	75(73)	22	134(180)	18
Ami	6	12	95(161)	8	293(596)	4
Beni	14	30	94(104)	26	165(304)	22
Cilla	10	11	131(130)	9	269(220)	7
Dovi	15	21	58(80)	19	76(160)	15
Erica*	3	10	93(107)	10	232(308)	7
Eseta	9	16	106(147)	12	240(465)	10
Fili	20	4	-	-	-	-
Gina	32	17	153(165)	14	233(359)	12
Aggregate	15	150	**96**(112)	120	**178**(279)	94

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

Yolande (02F) : 5 December 2002

A Tropical Depression (02F) was first identified embedded in an active monsoon trough over Southern Tuvalu on 29/1800 UTC November 2002. Around this time, shear was quite significant making if difficult to accurately locate the llcc. On Quikscat, the strong winds were confined to the northeast semicircle, under the associated active and deep convection. From the initial developmental stages, 02F was generally drifting southwards. By 30/1800 UTC, deep convection had increased about the llcc. It was then lying slightly south of an upper ridge axis. SST was around 30C. Up till this time, the potential for development to a tropical cyclone was low. Around 01/0600 December, convection had increased and cooled further about the system. Organisation had also improved with spiral bands beginning to wrap around the llcc. Subsequently, the potential to reach TC status was upgraded to moderate. 12 hours later, organisation had somewhat decreased. Shear was about moderate but revealing also that 02F was still under diurnal influence. Around 02/0600 UTC, the system had lost its organisation further. Potential for development was then downgraded to low. However, by 02/1800 UTC, organisation showed improvement. CIMSS Page showed that shear was minimal then. Organisation continued to improve as the system tracked further southeast. By 03/1800 UTC, spiral bands were evidently feeding into the centre, now under the deep convection. Outflow also improved. Again, the potential was raised to moderate. As a consequence, the first international marine warning on 02F was also issued, mentioning winds possibly increasing to 35knots in the next 24 to 36 hours. At 04/2255 UTC, TD 02F was named TC Yolande while located about 90 nautical miles east of Nukualofa, the Capital of Tonga.

Yolande continued to move southeast accelerating slightly after being named. By 05/0600 UTC, the llcc was exposed under increasing northwest shear. 6 hours later, it was evident that Yolande was encountering stronger shear. The llcc was then exposed about 100nm to the northwest of the deep convection. Consequently, Yolande was downgraded to a Tropical Depression at 05/1200 UTC.

Damage brought by TC Yolande, if any, is probably minimal.

Zoe (04F) : 25 December 2002 – 01 January 2003

Tropical Cyclone Zoe was perhaps one of the most intense cyclones seen in the RSMC Nadi AOR yet. Zoe was the second tropical cyclone of the 2002/2003 South Pacific Tropical Cyclone Season (Nov-Apr). The cyclone formed to the north of Rotuma and moved steadily westwards, undergoing rapid intensification. It passed close to the islands of the Temotu Province (Solomon Islands) before turning southeast and passing about 180nm to the west of Fiji. Tropical Cyclone Zoe had a total life span of about seven days and a peak intensity of about 130 knots (10-minute average). The cyclone affected the islands of Fataka, Anuta and Tikopia (all in the Temotu Province) with severe damages mostly to vegetation and infrastructure.

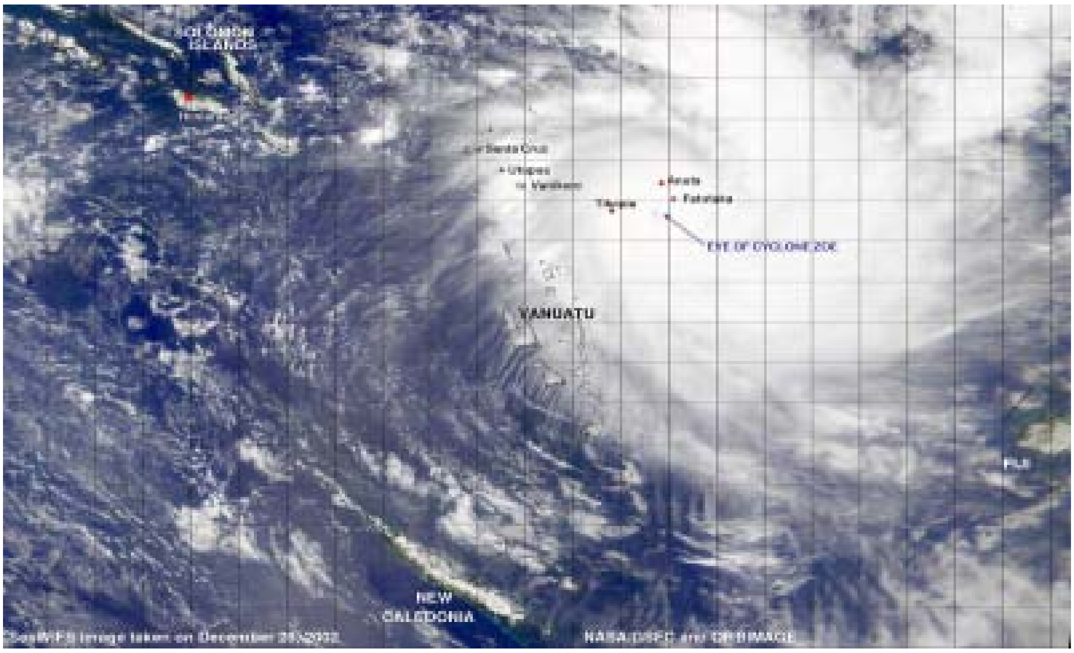


Figure 2 **TC Zoe over Eastern Solomons. [SeaWIFS Imagery : *Courtesy of NASA/GSFC and ORBIMAGE*].**

A Tropical Depression (04F) was first identified within the SPCZ about 360nm to the east of Funafuti in Tuvalu around December 23/2100 UTC 2002. The depression generally moved west-southwest while developing slowly. Around 25/09000 UTC it was located about 130nm to the north-northeast of Rotuma and still drifting west-southwest. Overnight, convection erupted over the llcc and rapidly cooled. Spiral bands'curvature increased markedly while wrapping tightly around the centre. Outflow over the system also significantly improved overnight. Vertical shear decreased significantly over and downwind of the depression. Subsequently, at 25/2100 UTC, the depression was upgraded to a tropical cyclone and named Zoe. With gale intensity, Zoe at this stage was located about 120nm to the northwest of Rotuma and moving westwards at about 10 knots.

Vanuatu was routinely provided with Special Advisories (18 in all), commencing at 26/0200 UTC. These advisories contained information on the latest and forecast positions, intensity and movement trends, with special mention of weather and sea effects.

Zoe continued to intensify very rapidly attaining storm intensity around 26/0600 UTC and hurricane intensity by 26/1800 UTC. By 27/0000 UTC, the eye was clearly evident. Around 27/1200 UTC the cyclone turned towards the southwest, passing between the islands of Anuta and Fataka slightly after 27/1800 UTC. Zoe reached peak intensity around 28/0600 UTC when it was located just east of Tikopia. Between 28/0600 UTC and 29/0000 UTC, Zoe executed a small clockwise loop after which it began to track southeast.

Zoe began to rapidly weaken, under strengthening shear and cooler SSTs, as it continued on its southeast track, passing about 180nm to the west of Nadi (Fiji) around 31/0600 UTC. The cyclone was downgraded to a tropical depression, by 0000 UTC on the 1st of January, 2003. It was then located about 210nm to the southwest of Nadi.

Damage to vegetation and infrastructure was severe on the island of Tikopia although amazingly no deaths or major injuries were reported on this island. Residents took shelter in mountain caves and hence survived the fury of Zoe. They claim that 5-10m storm surge waves inundated the coasts engulfing most of the villages. Media reports state that crops on Tikopia were totally destroyed and that it would take at least three years for the residents of Tikopia to grow all the food they needed. Initial surveys have revealed that about 70 houses were destroyed and some waters sources were contaminated by seawater. Most of the damage on Tikopia was perhaps due to the fact that the cyclone became slow moving for about 12 hours while executing the clockwise loop just east of the island.

Fataka island is uninhabited. On Anuta, no deaths or major injuries were reported and damage to vegetation and infrastructure was considerably less than that on Tikopia. About 90% of the houses remained intact and 70% of vegetation unharmed. Communication to the islands were severed following the passage of the cyclone but was re-established about a week after.

In Vanuatu, some islands in the northern parts of the country experienced inundation by seawater. Some villagers collected fish in their village greens when the waters receded. The extent of damage is yet be ascertained. However, a survey by French Military found that there were no fatalities on the islands of Mota Lava.

In Fiji, no damages were reported although people living around the southwestern coasts of Viti Levu reported seeing large waves out to sea. There was apparently no inland inundation by these waves. Yasawa reported maximum average winds of 33 knots, while at Nadi, a maximum gust of 40 knots was recorded.

Although Tropical Cyclone Zoe can be claimed to be the most intense tropical cyclone yet in the SW Pacific (with Dvorak Technique), this however, still needs to be verified.

Ami (05F) : 12 - 15 January 2003

Ami was the first tropical cyclone to form in RSMC Nadi's AOR in 2003. It was a relatively intense tropical cyclone with maximum (10-minute) average winds of about 80 knots and momentary gusts of 120 knots at its peak intensity. The cyclone caused destructive to very destructive storm to hurricane force winds over Fiji's Northern and Central Divisions, and damaging gale force winds over Tonga and Tuvalu. Damage in Fiji was extensive and severe due to high winds, heavy seas and torrential rainfall that led to the worst ever flooding in the northern town of Labasa. 17 lives were lost with at least 3 persons still missing.

A Tropical Depression (TD 05F) was first identified as an embedded system in an active monsoon trough to the east of Tuvalu, or about 240 miles east of Funafuti at around 09/2100UTC January 2003. It steadily moved southwest to lie close to Niulakita early on the 12th, with development greatly affected by diurnal influence and relatively strong vertical shear. However, overnight on the 11th, 05F underwent rapid development and subsequently it was named *Ami* around 0000 UTC on the 12th, while located just east of Niulakita. It was then moving steadily southwest with gale intensity. As the cyclone neared Rotuma it started to turn southwards, meanwhile intensifying into a storm. Throughout the 13th, *Ami* accelerated steadily south towards Fiji as it intensified further, making landfall along the northern coast of the country's second largest island Vanua Levu around 13/1400 UTC with hurricane force winds. The cyclone speeded through Fiji's Lau Group during the 14th, reaching peak intensity around 14/0600 UTC while located about 60nm south-southwest of Lakeba. It gradually swung southeast as it left the country. The system brushed past southern part of Tonga late on the 14th whilst on its way out of

RSMC Nadi-TCC's AOR. *Ami* retained its tropical cyclone characteristics for another 18 hours inside TCWC Wellington's AOR before becoming extra-tropical at 15/1200 UTC.

Most of the damage in Tuvalu was on Niulakita island. Damage to housing was moderate but fruit-bearing tree crops and coastal areas were severe. Rotuma and Futuna, though experienced strong winds, were spared from any significant damage.

In Fiji, the total confirmed number of fatalities was 14 with three people still missing. Damage was severe in the social, economic, infrastructure and utilities sectors, particularly in the Macuata, Cakaudrove and Lau Provinces. Communication to and from, as well as within these areas was severed for several days after the passage of *Ami*. Severe flooding of Labasa Town took a heavy toll on the township's residents and caused serious health and environmental risks. Water supply in the Northern Division was severely disrupted, leaving residents without clean drinking water for several days, subsequently forcing Government to cart fresh water from mainland Viti Levu. Torrential rain also caused landslides in several areas. High waves and heavy surge generated by *Ami* caused coastal and inland inundation in many areas along the cyclone's path, which in some cases was quite severe. The estimated cost of damage inflicted by *Ami* was $F104 million as released by the Fiji National Disaster Management Office (NDMO).

In Tonga, damage was minor and mainly to fruit-bearing trees, except for the inter-island ferry M V Olovaha left stranded on a reef in Tongatapu.

Beni (06F) : 25 - 31 January 2003

TC Beni developed in the vicinity of the Solomons. It was named at 25/0000 UTC while stalling just southeast of Rennell Island in the Solomons, apparently executing a clock-wise loop. Once it emerged out of this loop, it tracked slowly south-southwest before turning southeast, while accelerating a little. The centre of *Beni* remained over open waters between the Solomons, New Caledonia and Vanuatu for its entire life. The cyclone reached peak intensity of 110 knots at 29/1200 UTC while located about 210nm west of Port Vila and heading southeast at 11 knots. Most of the damage caused by *Beni* was from sea swell/surge. However, the remnants of former TC Beni eventually washed up on the Queensland coast, Australia, where it caused widespread rain and flooding. One person was killed as a result of this flooding.

A tropical disturbance was first identified on the MSL charts at 19/1800 UTC embedded along a monsoon trough and moving west-southwest about 05 knots. It was then located over 200nm to the northeast of the eastern parts of the Solomons. Lying under a diffluent upper flow and SST around 30C, 06F intensified while steadily drifting west-southwest. Till the 23^{rd}, the low level cloud centre (llcc) was still exposed with deeper convection sheared off to the west. On the 24^{th}, convection began to increase about the llcc, as shear abated. Overnight, convection erupted over the llcc with outflow fair in all quadrants and developing further. Organisation underwent a marked improvement and subsequently, the system was named *Beni* at 25/0000 UTC.

Beni made a slow clock-wise loop over to the southeast of Rennell after being named. It also encountered shear and diurnal influence, making development rather reticent. Nonetheless, at 26/0600 UTC, the partly exposed llcc slipped back under the increasing convection with spiral bands wrapping tightly around the centre. It was then upgraded to a Storm. Conditions continued fluctuating after this with shear significantly playing a retarding role on intensification. At 28/0000 UTC, a ragged and cloud-filled eye-like feature appeared in the Visible imagery only. During the evening this feature disappeared, to only reappear in the early hours of the 29^{th}, well-defined and shrinking in size. After re-analysis, *Beni* was found to have attained hurricane intensity around 28/0000 UTC. Following some explosive development early on the 29^{th}, *Beni* intensified rapidly to reach its peak winds at 29/1200 UTC.

The cyclone's demise was more rapid than its development. Under increasing shear, warmer air entrainment and anomalously cooler SSTs *Beni's* structure began to dissipate after 29/1200 UTC. After 31/1200 UTC, it was further downgraded to a depression, while located about 120nm south of New Caledonia. Between the 30th and 31st, *Beni* had changed course from southeast through south to southwest, influenced by a building ridge to the south.

Damage in Vanuatu was mainly from sea swells/surge causing inland inundation in some coastal areas.

Cilla (07F): 25 - 30 January 2003

Cilla was a minor tropical cyclone, with respect to intensity and effects. 07F developed to the west-northwest of Fiji around the 25th and steadily trekked southeast. It was named *Cilla* just east of the Lau Group, Fiji, and heading towards Tonga at 27/0000 UTC. Shear continually affected the cyclone as it continued east, arresting intensification and making it difficult to locate the llcc. Consequently, it was downgraded to a depression at 29/0600 UTC. The cyclone reached peak intensity of 40 knots at 29/0000 UTC while located about 260nm southeast of Niue.

An area of persistent deep convection was located about 180nm north-northwest of Nadi around 25/1800 UTC and moving slowly southeast. It was then lying under an upper ridge axis with favourable diffluent flow aloft. The system was embedded in a quasi-stationary monsoon trough lying northwest-southeast across Fiji and Tonga. At the far northwest end of this trough was Tropical Cyclone *Beni*. Shear and dense cirrus made it difficult to locate the llcc using satellite imagery through the 26th. On Nadi Radar, multiple eddies were detected but not the common one. However, through the morning of the 27th, the main llcc was located about 150 nm east of Fiji. Coldest tops were confined to the northeastern quadrant of the system at this time. At 27/0000 UTC the llcc slipped under the deep convection and subsequently 07F was named *Cilla. Cilla* steadily moved southeast across the central parts of Tonga and keeping well south of Niue. The cyclone gradually accelerated to 20 knots through the 28th, but abruptly slowed on the 29th. Shear caught up with the system then and subsequently caused its decay after 29/0600 UTC. It became extra-tropical late on the 30th, some 375 nm southwest of Rarotonga.

Damage in Tonga was confined to vegetation and fruit-bearing trees. Strongest winds recorded at Ha'apai were 28 knots with gusts to 58 knots. Power on Lifuka, the main island of the Ha'apai Group was out for about 3 hours during the night of the 27th, as *Cilla* moved southeast across central parts of Tonga. Communications was also affected but restored the next day.

Dovi (09F) : 05 - 10 February 2003

Dovi was yet another intense tropical cyclone to form in RSMC Nadi AOR in 2003. The cyclone developed over the Northern Cooks waters maintaining a general southerly track for most of its life, which was spent over open waters. Though it came to close proximities of Palmerston Island in the Southern Cooks and Niue, no fatalities or damage, apart from swell/surge along coastal areas, are known to have been caused by *Dovi.*

09F was almost an instant development, at the expense of 08F, which was being monitored to the east-southeast of American Samoa up till the 4th. 09F was first identified on the MSL charts around 05/0000 UTC, while located about 120nm southwest of Manihiki in the Nothern Cook Islands. It was embedded along an active SPCZ. Since inception, the system began drifting southwards about 10 knots. 6 hours later, under minimal shear, convection began to rapidly increase about the llcc. Overnight, though, deep convection increased and cooled further with very significant improvement in organisation. 24 hours after detection, 09F was named *Dovi*, while located about 60nm southeast of Suwarrow Island in the Northern Cooks and moving south-southwest about 08 knots.

Overcoming some diurnal influence, Dovi continued to intensify under increasingly favourable conditions. By 06/1800 UTC, the cyclone reached storm intensity. At this time, the cyclone was located about 160nm south of Suwarrow island and heading southwest about 08 knots. 12 hour later, by 07/0600 UTC, the system underwent explosive development, subsequently attaining hurricane intensity. Dovi peaked at 110 knots around 08/1800 UTC while located about 120 nm east-southeast of Niue island and heading southwest, but anticipated to gradually turn southwards under a mid-level sub-tropical ridge to the east. At 09/0600 UTC, while turning south, weakening was anticipated to be rather rapid as the strengthening steering field was pushing the cyclone rapidly into very strong shear regime. By 10/1200 UTC it had weakened to a storm. 12 hours later, inside TCWC Wellington's AOR, with shear stripping off the deep convection, *Dovi* became extra-tropical.

Erica (13F): 3 - 16 March 2003

Erica was the first tropical cyclone of the 2002/2003 season to be named by Brisbane TCWC, inside the Queensland Tropical Cyclone Warning Centre's AOR. However, it was New Caledonia that was to bear the brunt of the cyclone as it carved its swath eastward over the Coral Sea to become the strongest cyclone to affect this nation in recent history.

The cyclone originally developed from a tropical low embedded in a monsoon trough north of the Tiwi Islands, in Australia's Northern Territory on February 13th. Two days later it crossed inland near the Western Australia/Northern Territory border. The low then trekked across the interior of Australia, passing to the south of Alice Springs and then back towards Queensland. By March 3rd, it entered the Coral Sea near the Whitsunday Islands. By 03/2300 UTC, Quikscat showed the llcc well removed from the gales, which were located in an area of heavy rain that appeared to be associated with a zone of warm air advection generated as a thermal trough at 700 hPa developed over the region. Shear abated through the 4th and by 04/0600 UTC, it was named *Erica* while located about 425 miles east-southeast of Townsville.

Soon after being named, *Erica* was embedded in an elongated north-east to southwest cloud structure. Under the influence of a low to mid-level ridge to the south, *Erica's* llcc was steered back towards the west-northwest, and thence on a path generally between the north and northwest while losing its upper-level cloud structure against moderate shear. *Erica* eventually lost cyclone status at 07/2230 UTC. During this initial period as a cyclone, Erica attained a peak intensity of 55 knots.

For the next six days, the llcc of the remnant depression drifted slowly to the northeast and thence eastward, to lie just south of the Solomons. During this time it regained an upper-level cloud structure under improving conditions favouring redevelopment. Eventually *Erica* was renamed as a tropical cyclone at 10/1800 UTC whilst located about 200nm south-southwest of Honiara and moving south-southeast. For the following two days as it intensified reaching hurricane intensity at 11/1800 UTC. By 13/0600 UTC *Erica* was located approximately 300nm west-northwest of Noumea, New Caledonia, moving southeast at 8 knots under a weak mid-level ridge to its east. At this time, *Erica* reached its peak intensity of 115 knots. The cyclone's eye had shrunk in diameter and become symmetrical. Outflow remained good in all quadrants; however, UW-CIMSS charts depicted increasing upper-level shear to the south of the cyclone.

Erica made landfall a little after 13/1800 UTC approximately 120nm northwest of Noumea. The cyclone centre was then accelerating southeast along the island, over land, crossing out to sea at the extreme southern end of the island. It became extra-tropical by 15/1200 UTC while heading steadily southeast.

At Cape Tribulation, damage was significant with trees uprooted, large branches broken. One such felled branch crushed a car. In the Mossman and Port Douglas areas reports included leaves being stripped from trees, trees being blown almost horizontal to the ground, large trees being blown over and boats dragging their moorings. One large tree fell on a house at Oak Beach, some 15 km south-southeast of Port Douglas. Power was lost in several areas due to downed power lines by trees and felled branches. The northern beach suburbs of Cairns were also affected with similar damage.

Erica's main impact was on the main island of New Caledonia. Damage was extensive along the main island's west coast and in the capital, Noumea. Roofs were torn off, trees uprooted, power and phone lines cut, and roads closed. Many root crops were destroyed in the Northern Province; however, the water supply system was left largely intact. *Erica* left up to 1000 homeless as well as seriously damaging public buildings. Two fatalities were reported with nine people seriously injured and over one hundred with less serious injuries.

The small towns of Bourail, Kone, Pouembout, Koumac and Voh in the North Province suffered extensive damage including loss of electricity and telecommunications. In the small village of Pohe, up to 90 percent of crops were destroyed. Extensive damage was also reported in the southern village of Yate near the main hydro-electric dam, where about half of the population was left without shelter.

Schools sustained damage estimated at more than US$15 million, particularly to secondary schools the university. The French government immediately released more than US$25 million to rebuild 1000 homes in New Caledonia destroyed by the cyclone. A further contribution of US$ 7 million to meet the full cost of the emergency housing program was anticipated.

Eseta (12F) : 10 – 14 March 2003

Eseta was a relatively intense tropical cyclone whose development was enhanced by the favourable MJO pulse propagating eastwards at the time, inside RSMC Nadi AOR. The cyclone developed about 300nm north-northwest of Nadi, and circumnavigated Fiji on its way towards Wellington's AOR. In executing this, it kept well away from Fiji until it changed course towards the east to come within 80 nm of Ono-i-Lau, the southern-most island of the Group. As it continued east, the cyclone also came within 60nm of Tongatapu Group in Tonga. Tropical Cyclone *Eseta* attained a peak intensity of 100 knots while located southeast of Ono-i-Lau.

A tropical disturbance was first identified on the MSL charts on March 8th about 60nm west of Rotuma, with little organisation and drifting generally towards the west. 12F was apparently influenced by shear and diurnal variations which effectively subdued any development. On the 10th, the system was lying under a diffluent upper outflow and minimal shear region with the llcc partly exposed. Quikscat pass in the evening confirmed presence of gales though confined certain sectors and some distance away from the centre. Overnight, convection increased with banding wrapping tightly around the llcc. 12F was then named *Eseta* at 10/1730 UTC, while located about 300nm west-northwest of Nadi and moving south about 05 knots. After re-analysis though, *Eseta* attained tropical cyclone status around 10/1200 UTC.

After being named, the cyclone went through some explosive intensification reaching storm by 11/0000 UTC and developing a ragged eye by 11/0600 UTC. However, intensity was not upgraded to hurricane till 12/0000 UTC. In retrospect, *Eseta* attained hurricane intensity around 11/1800 UTC. The cyclone was then located about 260nm south-southwest of Nadi and moving southeast about 12 knots. Under a well-established mid-level ridge over Fiji, the cyclone was steered around it but eventually to within 80nm of Ono-i-Lau, the southeast-most island of the Group. On it way out of Nadi AOR, it brushed past, within 60nm of Nukualofa, the Capital of Tonga. Eseta steadily accelerated after 12/0000 UTC and continued to steadily intensify to reach its peak around 13/0600 UTC with 100 knots close to centre. It was then located about 150 nm west-southwest of Nukualofa. By 13/0600 UTC, it accelerated further to about 25 to 30 knots under a near gale northwest steering field, and into stronger shear region. As a consequence, Eseta rapidly lost its organisation and warm-core characteristics and by 14/1200 UTC, inside TCWC Wellington's AOR, it became extra-tropical.

Tropical Cyclone Eseta spent its life at sea, passing well to the south of Fiji. Except for some heavy rain and flash flooding, damage if any was minimal. In Eua, Tonga, damage was mainly to fruit-bearing trees, root crops and kava. There are no known reports of casualties as a direct consequence of this cyclone.

Fili (16F) : 13 - 15 April 2003

A persistent area of deep convection was first identified about 200nm northeast of Fiji around 13/0000 UTC moving southeast slowly. The disturbance was then lying under an upper ridge axis in a weak shear regime. At the surface, SST was around 30°C. Suggestions of cyclonic curvature of low-level clouds were evident then. Late on the 14th, shear was increasingly becoming more prominent, keeping the deep convection displaced to the southeast of the llcc. Overnight, though, 16F was caught up in a strong northwest steering field, accelerating the system through central Tonga. This subsequently neutralized the resultant shear on the 16F, thus allowing for further development. Around 14/1800 UTC, it was named *Fili,* while located about 210nm east-northeast of Nukualofa, Tonga, and moving southeast at 20 knots. Intensity was then estimated at 35 knots and with potential to increase further. Shortly after 15/0000 UTC, *Fili* made its exit from RSMC Nadi AOR into Wellington TCWC's with 45 knots and moving southeast at 35 knots. It became extra-tropical by 15/1200 UTC under intense shear. *Fili* peaked around 15/0600 UTC with a maximum average wind speed of 50 knots close to the centre, attributed partly to its translational speed. No damage or casualties are known to have resulted from *Fili.*

Gina (17F) : 4 - 9 June 2003

Gina was first identified as a westward-moving depression to the northeast of Vanuatu within an area of fairly persistent convection stretching west toward the Solomon Islands on June 4th. Late on the 4th, 17F was moving towards the west-southwest at about 05 knots under the steering influence of the low to mid-level ridge to the south. Under favourable conditions, the system developed further and was subsequently named *Gina* at 05/0600 UTC about 240nm northeast of Espiritu Santo, Vanuatu.

Throughout the 6th, *Gina* accelerated a little to lie within 30nm to the north-northwest of the northern tip of Espiritu Santo. All this while, the cyclone was gradually intensifying. At 07/0000 UTC, it attained hurricane intensity, while steadily on a west-southwest track and generally away from Vanuatu. While the organization remained good, convection was diminishing gradually. *Gina* reached peak intensity of 80 knots at 07/1800 UTC while located about 730nm west of Port Vila, Vanuatu. By this time the cyclone had slowed considerably and in the initial stages of an anticlockwise loop. *Gina* had also, at this time, moved into a region of stronger shear and cooler SSTs. Gina's demise was rapid with convection torn away from the llcc to the southeast by the strong shear. By 09/0600 UTC *Gina* had lost its cyclone characteristics and was subsequently downgraded to a depression. It was located about 730nm west-northwest of Port Villa.

No report of damage or loss of life, from either of the islands in the eastern Solomons or northern Vanuatu due to *Gina* has been received. However, the Australian media reported that the vessel *Grace 2* sailing from Bowen (North Queensland) to Vanuatu foundered when it encountered *Gina* on the 8th. A mayday was broadcast, and in a three-hour rescue operation, the Indonesian Ship *Daio Copihue* picked up the crew while en route from New Zealand to Japan.

Reference:

1. ***Australian Bureau of Meteorology web site***, http://www.bom.gov.au/, for Monthly SOI values and 5-month running mean, from 1997 to 2002.

APPENDIX V

MEMBERS' CYCLONE SEASON REPORTS AND POWERPOINT PRESENTATIONS

(available in French only)

BILAN DES SAISONS CYCLONIQUES 2002/2003 ET 2003/2004 SUR LA NOUVELLE CALÉDONIE

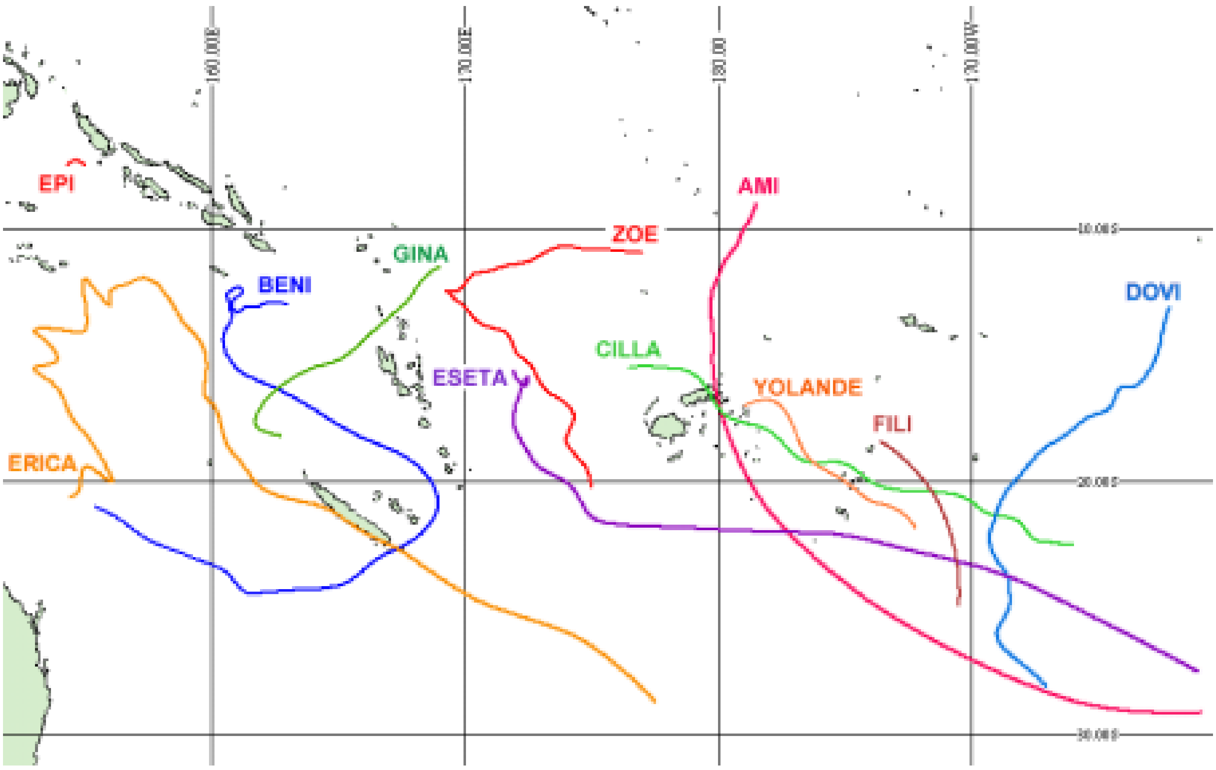
(Présenté par la Nouvelle Calédonie)

I LA SAISON 2002/2003

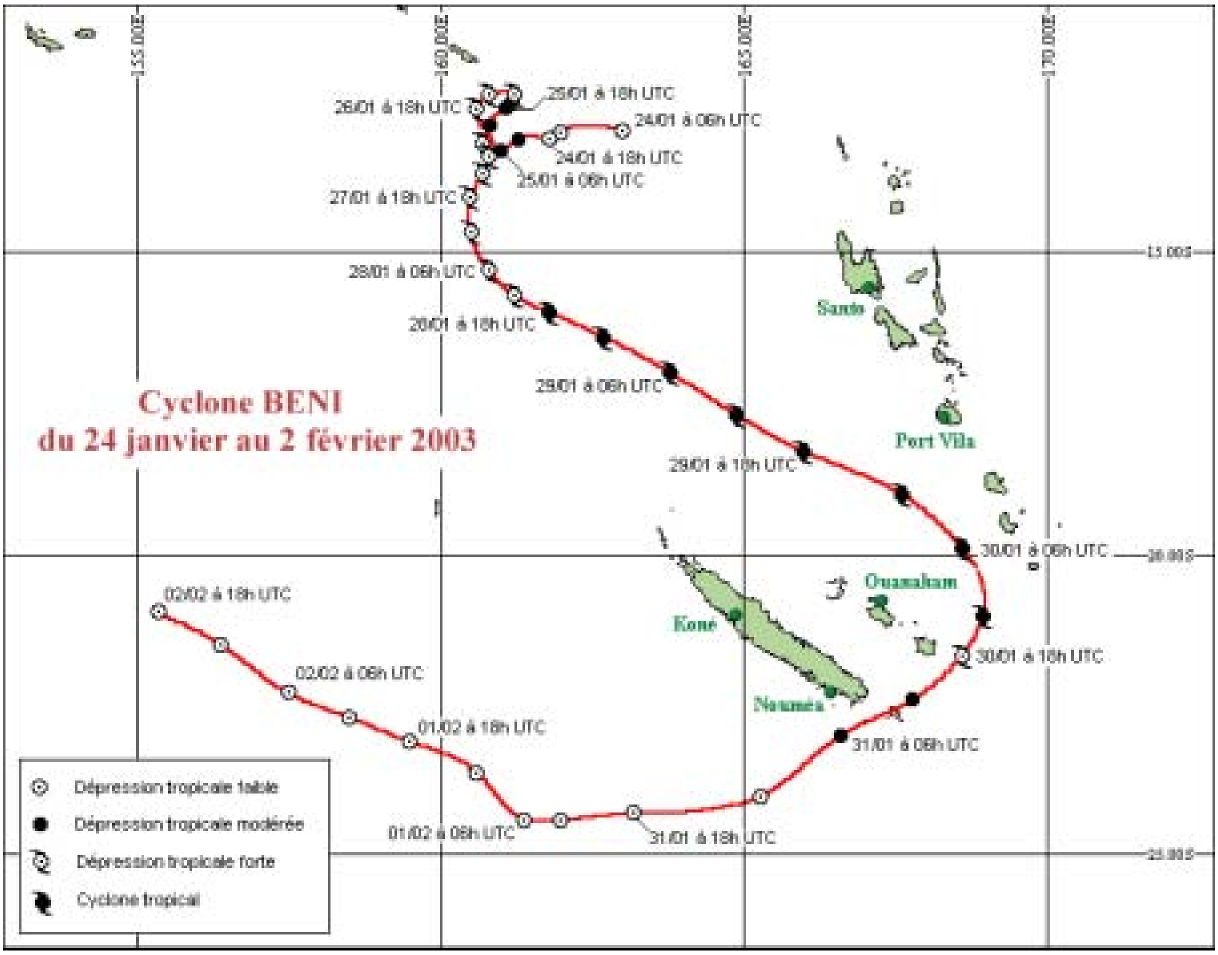
Pour la zone Nouvelle Calédonie, la saison 2002/2003 est marquante à plus d'un titre.

La première c'est le nombre élevé de cyclones (4) par rapport à la normale qui ont intéressé notre zone. Ensuite c'est le passage de Zoé, cyclone exceptionnellement intense, dans la zone d'alerte, sans toutefois menacer le Territoire directement.

C'est surtout le passage dévastateur du cyclone Erica qui restera gravé dans les mémoires. C'est enfin l'arrivée très tardive de Gina au mois de juin à proximité du nord de la Grande Terre, sans toutefois provoquer de dégâts.



I-1 cyclone tropical Beni



Beni est le premier cyclone de la saison à menacer directement la Nouvelle Calédonie.

Pendant le passage de Beni, les régions les plus exposées au mauvais temps ont été les îles Loyauté, le sud de la Grande Terre et l'île des Pins. Ainsi, les précipitations les plus importantes ont été recueillies dans le Grand Sud avec un total sur 3 jours dépassant les 100 mm à Yaté, à la Rivière Blanche et atteignant un maximum de 161,8 mm à la Montagne des Sources.

Les vents les plus forts ont soufflé sur le sud de la Grande Terre, sur les îles Loyauté et plus particulièrement à Lifou où des vents moyens de 90 km/h avec des rafales à 137 km/h ont été enregistrés à Ouanaham. On a également mesuré des rafales à 126 km/h à Thio, 122 km/h au Cap n'Dua et 111 km/h à Ouloup (Ouvéa).

C'est donc à Lifou qu'il y a eu le plus de dégâts avec des habitations endommagées, des coupures sur les circuits électriques et téléphoniques ainsi que des routes coupées par des chutes d'arbres.

Il faut noter que le comblement rapide de Beni a considérablement limité ses effets sur Maré et le sud de la Grande Terre. En effet le comblement a été spectaculaire, en 24 heures entre le 30 à 11 heures locales et le 31 à 11 heures la pression au centre est passée de 940 hPa à 990 hPa.

La pré-alerte a été activée à partir du 27 à 14 heures, l'alerte 1 a été mise en place à partir du 29 à 13heures 30 et l'alerte 2 à partir du 29 à 18 heures pour les Loyautés puis le sud du territoire.

L'ensemble des alertes ont été levées le 31 à 18 heures.

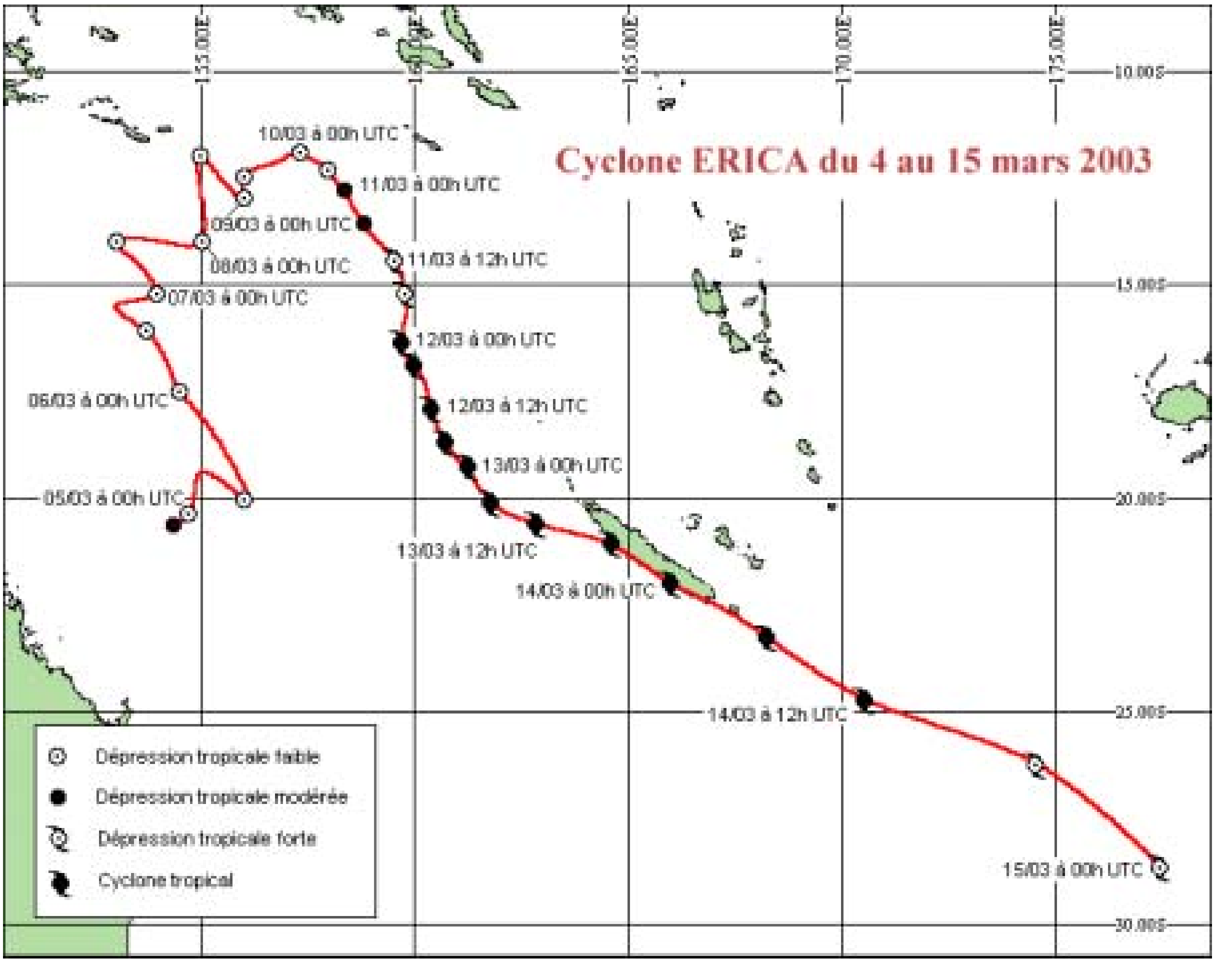
Tableau des précipitations en mm

STATIONS	29-janv	30-janv	31-janv	TOTAL
MT DES SOURCES	32,0	102,0	25,6	159,6
YATE MAIRIE	49,6	66,2	19,0	134,8
RIVIERE BLANCHE	42,4	77,4	3,8	123,6
KONIAMBO	47,0	1,6	42,0	90,6
MOUE	44,6	17,4	25,2	87,2
AOUPINIE	39,8	16,0	10,6	66,4
POINDIMIE	51,6	5,2	3,6	60,4
OUANAHAM	18,2	32,4	8,4	59,0

Tableau des vents maximum enregistrés

STATIONS	DM (°)	FM (km/h)	Date	DX (°)	FX (km/h)	Date
OUANAHAM	110	90,0	30/01/2003	100	136,8	30/01/2003
THIO SLN	090	82,8	30/01/2003	100	126,0	30/01/2003
CAP NDUA	210	93,6	31/01/2003	210	122,4	31/01/2003
OULOUP	100	68,4	30/01/2003	090	111,6	30/01/2003
POINGAM	100	72,0	29/01/2003	100	97,2	29/01/2003
MT DES SOURCES	080	68,4	30/01/2003	070	97,2	30/01/2003
LA ROCHE	120	(46.8)	30/01/2003	130	(93.6)	30/01/2003
BELEP	110	50,4	30/01/2003	120	93,6	30/01/2003
BOURAKE	160	57,6	31/01/2003	130	90,0	30/01/2003
PHARE AMEDEE	240	64,8	31/01/2003	190	86,4	31/01/2003
AOUPINIE	110	39,6	30/01/2003	090	86,4	30/01/2003
TOUHO	100	50,4	29/01/2003	100	86,4	30/01/2003
NOUMEA	100	57,6	30/01/2003	100	82,8	30/01/2003

I-2 Cyclone tropical ERICA



La dépression Erica se forme au début du mois près de l'Australie où elle devient dépression tropicale modérée et est rapidement nommée. Elle amorce ensuite un déplacement vers le nord-est et s'affaiblit. Pendant plusieurs jours elle se déplace lentement et reste faible. C'est à partir du 10 que la trajectoire s'incurve vers le sud-est. Elle se situe alors au sud des Salomon vers 12 Sud et 157 Est. Le 11 elle se renforce et redevient dépression tropicale modérée.

Elle se déplace alors à une vitesse d'environ 15 km/h. A partir du 11 son développement est assez rapide . Elle atteint le stade de dépression tropicale forte le 11 à 17 heures et vient de pénétrer dans notre zone d'alerte.

Elle devient cyclone tropical le 12 à 11 heures, sa pression au centre est alors estimée à 965 hPa et les vents maximum près du centre sont de l'ordre de 130 km/h. Erica se situe à 670 km au nord-ouest de Koumac et se déplace vers le sud sud-est à 15 km/h.

Le cyclone Erica va continuer son déplacement vers le nord du territoire en se renforçant progressivement.

Il atteint son maximum d'intensité le 13 à 23 heures avec une pression de 920 hPa au centre et des vents moyens maximum estimés à 215 km/h avec des rafales atteignant 320 km/h. Erica se trouve alors à proximité immédiate de la côte Ouest à 160 km à l'ouest de Koumac.

La trajectoire s'incurve légèrement vers l'est et le cyclone se dirige directement vers la côte Ouest, sa vitesse augmente à 30 km/h. Le centre du cyclone aborde la cote Ouest à la hauteur de Koné le 14 vers 05 heures.

Il va alors longer toute la cote Ouest avec une vitesse qui va augmenter régulièrement pour atteindre 50 km/h.

Son intensité reste très forte bien que la chaîne désorganise un peu la masse nuageuse. Le centre passe sur Bourail vers 08 heures, sur Tontouta vers 11 heures, sur Nouméa vers 12 heures et au sud de l'île des Pins vers 14 heures. Tout au long de la côte Ouest et sur l'île des Pins le scénario sera identique, les vents soufflent du secteur nord-est avec des rafales qui atteignent plus de 150 km/h, puis le vent se calme au passage de l'œil pendant un peu moins d'une heure. Ensuite les vents de secteur ouest reprennent soudainement avec violence et atteignent très rapidement 150 km/h en vent moyen avec des rafales à 200 km/ h.

Sur la côte Est le scénario est un peu différent car elle est exposée essentiellement aux vents de secteur est et nord. Le passage de l'œil sera bien moins net et les vents d'ouest ne pénètrent que dans certains endroits exposés, en sortie des vallées surtout.
Sur les Loyauté les vents soufflent du secteur nord assez fort et tourneront progressivement au secteur ouest.

Erica s'évacue rapidement au sud-est de l'île des Pins.

Le passage d'Erica est accompagné de pluies violentes, mais la rapidité avec laquelle il a balayé la Grande Terre limite la durée de ces pluies torrentielles. D'autre part il sera difficile d'avoir des mesures fiables car avec la violence du vent les pluviomètres n'ont pu récoltés qu'une partie des précipitations.

Erica a donc affecté l'ensemble de la Grande Terre avec des vents de force cyclonique, seules les Loyauté ont été quelque peu épargnées, mais malgré tout à Maré les vents maximum ont tout de même été supérieurs à ceux enregistrés pour Beni..

Le passage d'Erica a été accompagné de pluies violentes, mais la rapidité avec laquelle il a balayé la Grande Terre a limité la durée de ces pluies torrentielles.

Les données enregistrées font apparaître que les forces de vents sont exceptionnelles et que les records ont été battus. Ces records, établis lors de passages de différents cyclones, ont presque tous été dépassés lors du passage d'Erica.

Erica est donc un cyclone exceptionnellement violent et ravageur pour la Nouvelle Calédonie tant par les vents enregistrés que par les zones affectées.

Durant l'épisode le centre Météo France de Nouméa a émis 10 bulletins spéciaux pour la marine entre le 10 à 10heures et le 15 à 07 heures, 7 bulletins météorologiques spéciaux destinés au public entre le 13 à 17 heures et le 14 à 17 heures et enfin 9 bulletins météorologiques d'alerte destinés à la sécurité civile entre le 11 à 20 heures et le 15 à 07 heures.

La pré-alerte a été déclenchée à partir du 12 à 12 heures.

L'alerte numéro 1 a été déclenchée à partir du 13 à 05 heures sur Belep, à partir du 13 à 17 heures sur la province Nord, et le 14 à 05 heures sur la province sud et les Loyautés.

L'alerte 2 a été déclenchée le 13 à 23 heures sur le nord, le 14 à 07 heures sur le nord de la province sud et à 08 heures30 sur le reste de la province sud.

Les dégâts

Les dégâts ont été considérables, essentiellement sur la Grande Terre et l'île des pins.

L'ensemble des infrastructures ont été touchés, réseaux électriques et télécommunications, routes et bâtiments, agriculture.

Voici quelques chiffres qui donnent une idée de l'importance des dégâts :

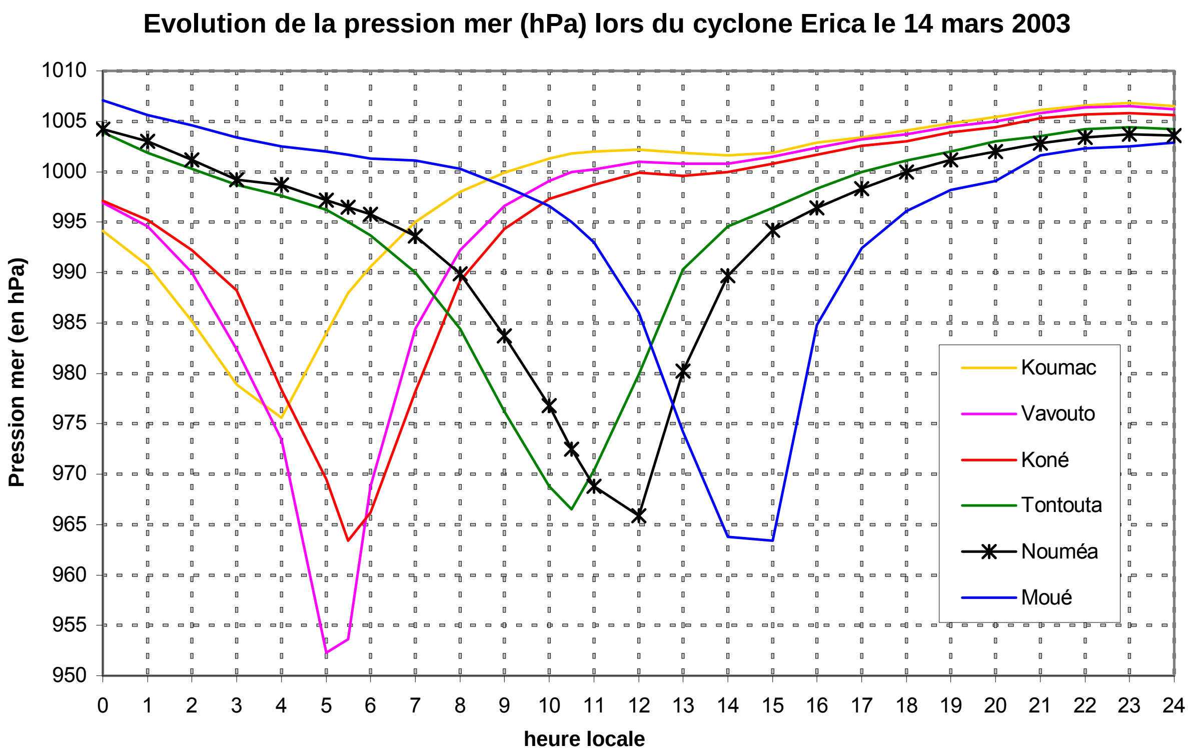
Agriculture : Plus de 3 milliards de dégâts déclarés qui se répartissent comme suit :

- Horticulture : 864 millions CFP 7,26 millions Euros
- Polyculture, élevage : 501 millions CFP 4,21 millions Euros
- Cultures pérennes : 457 millions CFP 3,84 millions Euros
- Elevage bovins : 450 millions CFP 3,78 millions Euros
- Elevage cervidés et petits ruminants : 238 millions CFP 2,0 millions Euros
- Cultures plein champ : 224 millions CFP 1,88 millions Euros
- Elevage hors sol : 186 millions CFP 1,56 millions Euros
- Aquaculture : 137 millions CFP 1,15 millions Euros

Enercal (fournisseur d'énergie electrique) : 1,2 Milliard CFP 10 millions Euros

EEC (Eau et Electricité de Calédonie) : 735 millions CFP dont 400 millions sur des éoliennes. 6.16 millions Euros

OPT (Office des Postes et Télécommunication) : 700 millions CFP 5.87 millions Euros



Sur ce diagramme d'évolution de la pression on voit bien l'homogénéité des mesures tout au long de la cote ouest ainsi que la chronologie du déplacement d'Erica.

Seule la mesure faite à Vavouto est sensiblement plus basse que les autres, cela s'explique car Vavouto correspond au point d'atterrissage d'Erica sur la côte ouest.

On note également la différence importante de pression à 05 heures locales, un peu plus de 17hPa, entre Vavouto et Koné distant d'une dizaine de kilomètres l'un de l'autre. Ce qui donne une idée du Gradient de pression près du centre au moment de son atterrissage.

Enfin on peut voir qu'entre Nouméa et l'Île des pins la pression a légèrement baissée, ce qui correspond bien à la réorganisation de la masse nuageuse observée avec l'image satellite.

VENTS MAXIMUMS OBSERVÉS LORS DU PASSAGE DU CYCLONE ERICA LE 14 MARS 2003

		Vent moyen maxi sur 10 minutes				Vent maximum instantané (rafale)			
Nom Station	altitude	Direction	Vitesse	Heure	Record	Direction	Vitesse	Heure	Record
POINGAM	30	310	108	02:30		320	162	02:15	
KOUMAC	23	330	94	04:14	133	320	169	04:14	184
DUROC	3	330	137	05:30		350	198	05:15	
VAVOUTO	93	Mqt	166	05:30		Mqt	234	05:15	
KONE	7	240	112	07:00		250	187	06:45	
NEPOUI	4	260	112	08:00	108	30	187	06:15	159
NESSADIOU	4	320	108	08:30	104	310	209	09:45	151
BOURAKE	45	Mqt	Mqt	Mqt		Mqt	Mqt	Mqt	
LA TONTOUTA	36	70	86	09:34	83	50	155	09:22	155
NOUMEA	69	190	144	12:28	104	170	202	12:19	159
PHARE AMEDEE	4	100	112	11:00	90	20	187	12:45	133
KONIAMBO	895	20	151	05:30		20	234	04:15	
AOUPINIE	945	Mqt	Mqt	Mqt		Mqt	Mqt	Mqt	
MTGNE SOURCES	780	30	122	11:00	133	20	227	10:45	230
POUEBO P.	15	Mqt	Mqt	Mqt		Mqt	Mqt	Mqt	
BELEP AEROD.	84	Mqt	Mqt	Mqt		320	126	01:00	
POINDIMIE	11	340	112	06:46	144	340	162	06:39	198
TOUHO AEROD.	4	330	101	06:00		320	158	06:45	
THIO SLN	18	300	130	10:30		300	176	10:45	
RIVIERE BLANCHE	165	Mqt	Mqt	Mqt		Mqt	Mqt	Mqt	
MOUE	93	70	101	13:00	101	190	191	15:45	144
OULOUP	7	Mqt	Mqt	Mqt		Mqt	Mqt	Mqt	
OUANAHAM	28	340	65	10:36	90	340	104	10:29	148
LA ROCHE	43	250	50	13:00	86	340	112	13:45	126

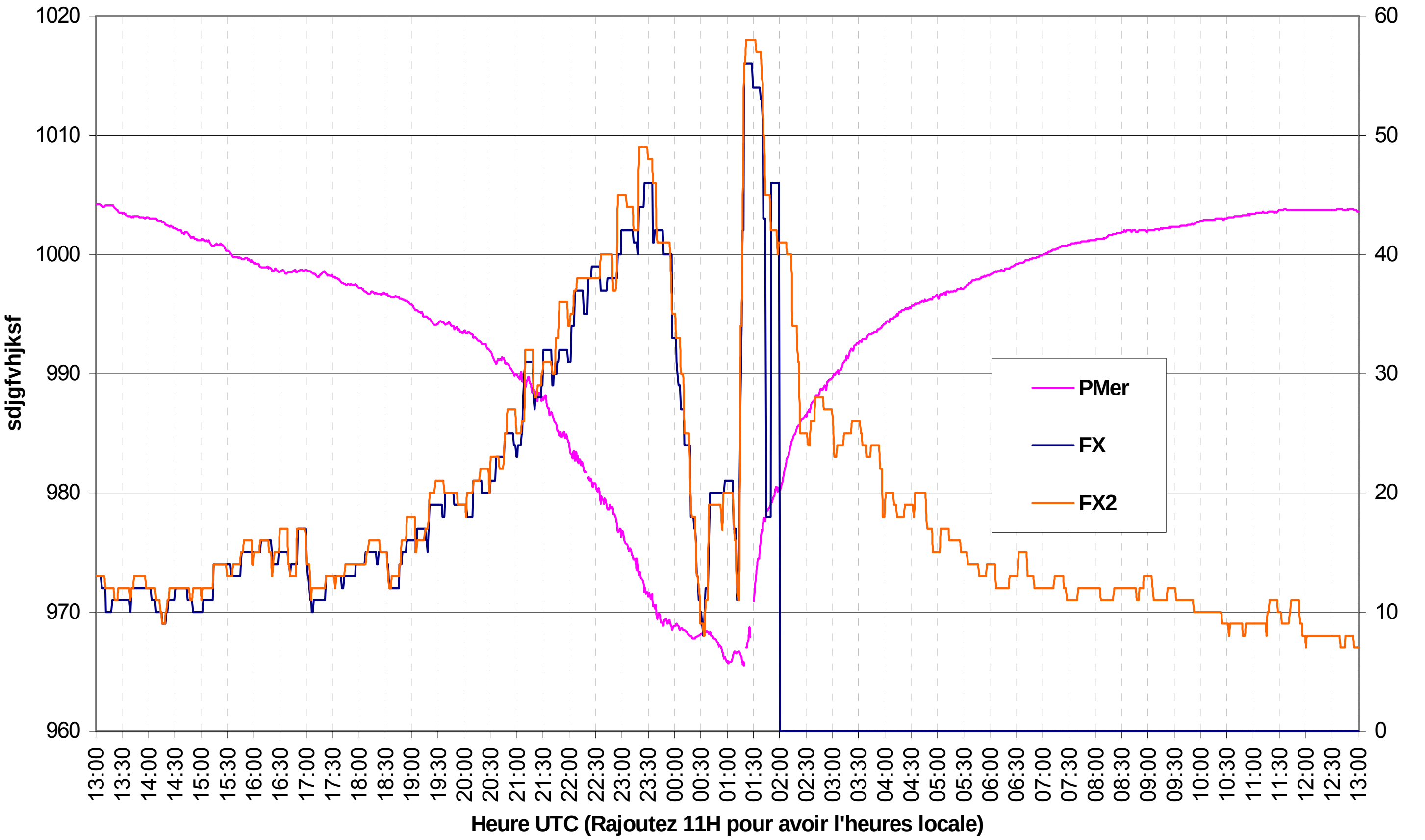
"Mqt" désigne les valeurs manquantes

Les directions sont en degrés d'où vient le vent (180° pour le Sud, 90° pour l'Est, etc)

Les vitesses sont en km/h

Dans ce tableau on voit que de nombreux records ont été dépassés.

Evolution des paramètres météorologiques à Nouméa lors du passage du cyclone ERICA



Les vents les plus forts ont été généralement mesurés après le passage de l'œil, donc des vents qui varient entre les secteurs nord-ouest et sud. Ceci s'explique par le fait que la côte ouest est relativement protégé par la chaîne centrale des vents de secteur est à nord-est.

Ce graphe nous montre l'évolution de la pression et de la force instantanée du vent.

Le paramètre Fx est la mesure officielle du vent à la station de Nouméa, FX2 est une mesure auxiliaire, située légèrement plus haut que la première. L'anémomètre principal a été détérioré à la fin du passage le plus fort.

On y voit bien le renforcement du vent à l'arrivée d'Erica, la décroissance rapide de la vitesse du vent dans l'œil du cyclone et surtout la violente reprise du vent au passage du mur de l'œil synchronisée avec la remontée rapide de la pression.

Précipitations relevées lors du passage d'Erica

Nom station	Commune	Altitude (en m)	12	13	14	Total
DZUMAC	YATE	891	3,0	149,4	145,0	297,4
COL ROUSSETTES	HOUAILOU	360	7,0	152,0	95,5	254,5
OUEHOLLE	KAALA-GOMEN	155	25,0	207,0	12,0	244,0
POCQUEREUX	LA FOA	38	1,8	198,0	40,0	239,8
RIVIERE BLANCHE	YATE	165	1,6	56,0	176,6	234,2
COULEE	LE MONT-DORE	7	0,0	61,5	170,0	231,5
KOPETO	POUEMBOUT	1001	34,5	150,0	6,0	190,5
YATE US.	YATE	4	1,2	31,0	157,4	189,6
PLUM	LE MONT-DORE	5	0,7	44,7	139,7	185,1
POINDIMIE	POINDIMIE	11	81,0	89,8	13,8	184,6
HOUAILOU P.	HOUAILOU	10	6,5	102,5	56,5	165,5
ME PARA	BOURAIL	835	6,8	150,0	8,6	165,4
PAITA	PAITA	19	4,9	23,0	125,0	152,9
LA FOA	LA FOA	20	1,0	115,0	35,0	151,0
POYA	POYA	10	19,4	91,2	39,8	150,4
TIEBAGHI	KOUMAC	595	8,0	136,0	5,0	149,0
BOURAIL	BOURAIL	24	2,4	76,4	69,4	148,2
YATE MRIE	YATE	12	0,6	23,2	123,4	147,2
VOH	VOH	10	15,0	110,0	21,5	146,5
BOULARI	LE MONT-DORE	35	2,6	29,6	111,5	143,7
GABE	BOURAIL	4	4,0	116,0	15,0	135,0
LA TAMOA	PAITA	65	5,7	40,0	88,0	133,7
KOUMAC	KOUMAC	23	6,6	122,8	4,0	133,4
NESSADIOU	BOURAIL	4	2,6	84,6	46,2	133,4
TONGHOUE	DUMBEA	35	5,8	15,0	110,2	131,0
POUEBO P.	POUEBO	15	60,0	65,0	1,6	126,6
TOUHO AEROD.	TOUHO	4	54,4	63,0	4,6	122,0
OUACO	KAALA-GOMEN	14	38,5	67,0	15,7	121,2
KONE	KONE	7	15,2	97,6	8,0	120,8
POUEMBOUT	POUEMBOUT	27	26,4	83,8	9,2	119,4
LA TONTOUTA	PAITA	36	5,6	25,2	86,2	117,0
TOUHO GEND.	TOUHO	4	55,0	55,0	7,0	117,0
NEPOUI	POYA	79	13,2	77,0	25,6	115,8
PHARE AMEDEE	NOUMEA	4	0,0	11,4	101,6	113,0
GOMEN	KAALA-GOMEN	13	12,0	86,5	13,0	111,5
KOUTIO	DUMBEA	18	1,0	29,5	80,5	111,0
THIO P.	THIO	6	1,0	41,0	68,8	110,8
CANALA	CANALA	25	1,5	50,0	55,5	107,0

I-3 Cyclone tropical Gina

L'activité convective est encore importante en ce début de mois de juin au nord du Vanuatu.

A partir du 3 une faible dépression se forme sous cette masse nuageuse et se décale vers le sud-est. Elle se creuse régulièrement et la masse nuageuse centrale s'organise.

Elle atteint le stade de dépression tropicale modérée et est baptisée Gina par le centre de Nandi. Elle se situe alors à environ 400 km dans le nord nord-est de l'île de Santo.

Evolution

Gina continue son déplacement régulier vers le nord de Santo en se renforçant.

Des bandes spiralées s'enroulent autour de la masse nuageuse centrale bien organisée mais de petite dimension. Elle atteint rapidement le stade de dépression tropicale forte le 5 à 18h utc.

Gina continue à se décaler vers le sud-ouest et continue à se renforcer. Un œil apparaît le 7 vers 00 utc et devient alors cyclone tropical. La pression au centre est alors de 970 hPa et les vents moyens sont estimés à 65 nœuds (120 km/h).

Gina se renforce encore pour atteindre sa force maximale le 7 à 00 utc, avec une pression au centre de 960 hPa et des vents moyens de 70 nœuds (125 km/h). L'œil est alors bien formé.

Gina garde son intensité jusqu'au 8 à 06h utc avec une trajectoire vers le sud-ouest.

A partir du 8 sa vitesse ralentit sensiblement et il amorce un virage vers l'est qui le rapproche de l'île de Surprise. Dans le même temps, les conditions deviennent défavorables, l'eau de mer.

Plus froide et surtout un cisaillement qui se renforce rapidement en haute altitude.

Gina va rapidement se combler à proximité immédiate de Surprise.

Commentaires

Gina est un phénomène exceptionnel en cette période de l'année.

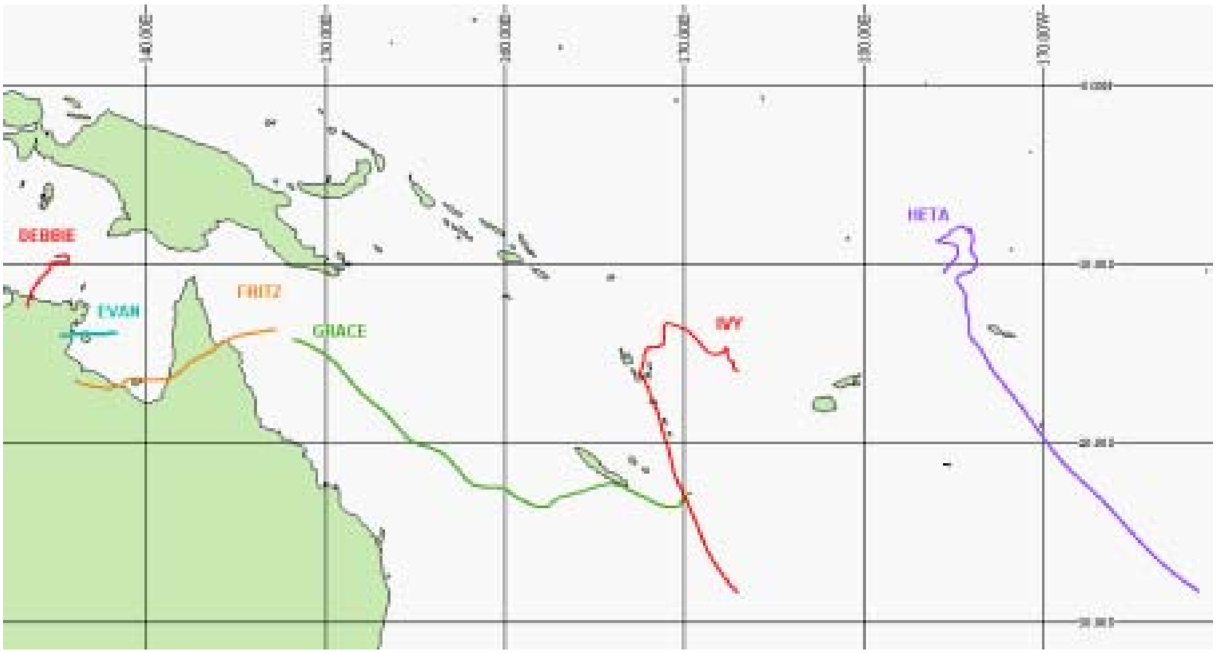
En effet, sur le Vanuatu et la Nouvelle-Calédonie, il faut remonter en 1972 pour trouver une dépression tropicale. Elle se nommait IDA et était une dépression tropicale forte ; elle avait atteint 63 nœuds, soit presque le stade cyclone, et était passée entre la Grande Terre et les Loyauté le 3 juin.

Le dernier cyclone formé en juin sur le pacifique sud-ouest date de 1997. Il se nommait KELY et avait atteint 70 nœuds et 970 hPa, il avait touché Wallis le 13 juin.

Sur la Nouvelle Calédonie Gina se manifeste surtout par des précipitations sur le Nord de la Grande terre et sur les Belep. Ces précipitations sont provoquées par des bandes nuageuses périphériques, car malgré sa proximité avec le nord du territoire, la masse nuageuse centrale est restée de petite taille et n'a donc pas affectée la Grande Terre.

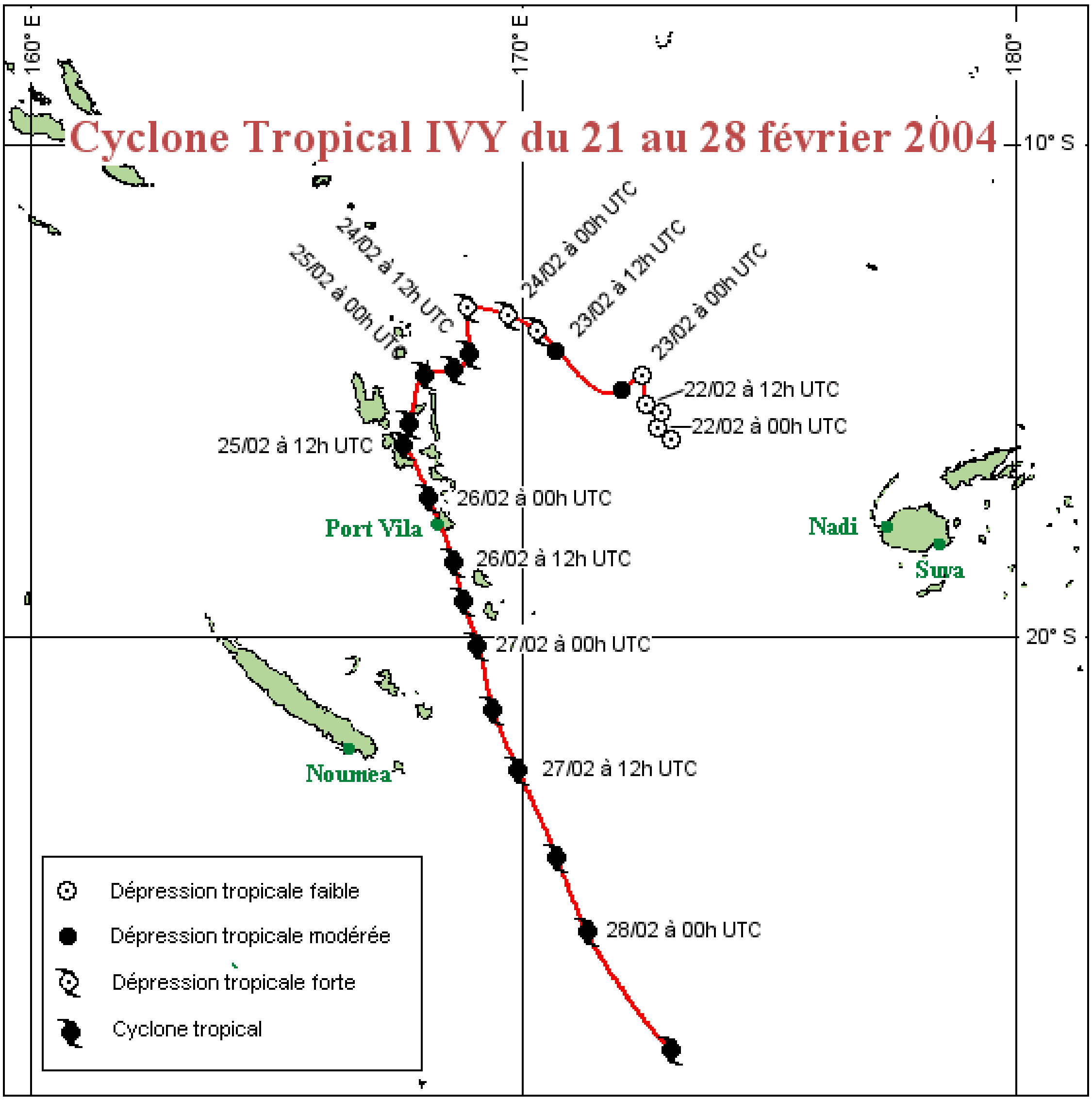
L'arrivée de Gina a nécessité la mise en pré-alerte du territoire entre le 6 à 15h locales et le 9 à 08h locales, et le passage en alerte numéro 1 du nord de la Grande Terre entre le 8 à 16h locales et le 9 à 08h locales.

II LA SAISON 2003/2004



Sur la zone Nouvelle Calédonie la saison est calme avec seulement deux phénomènes, ils ont tous les deux intéressés la Nouvelle Calédonie mais n'ont pas provoquer de dégâts.

II-1 Cyclone tropical Ivy



Ivy s'est formé dans l'est des îles du Vanuatu et a atteint le stade de cyclone tropical alors qu'il se situe à proximité immédiate des îles du nord de l'archipel.

A partir de ce moment là Ivy se déplace lentement et passe tout d'abord entre Ambae et Santo, puis sur Malekula. Il se dirige ensuite directement sur Efate, l'œil passe sur Port Vila. Il passe ensuite à l'ouest d' Erromango et de Tanna à environ 50 km.

Durant cette phase, le déplacement d'Ivy est assez lent (10 km/h environ) et son intensité continue d'augmenter, il atteint son intensité maximale le 25 à 18h00 utc près de Malakula avec une pression de 940 hPa et des vents près du centre estimés à 90 nœuds.

Les dégâts occasionnés sur les îles du Vanuatu sont donc considérables.

A partir du 26 à 1800 utc Ivy accélère sur une trajectoire sud sud-est. Sa trajectoire finale passe à l'est de la Nouvelle Calédonie le 27 entre 00h00 et 12h00 utc. Ivy se trouve au plus près des Loyauté le 27 à 0600 utc à une distance de 140 km à l'est de Maré. Il s'éloigne ensuite rapidement de la Nouvelle Calédonie. Il devient extra tropical mais reste bien organisé.

Ivy se déplace loin vers le sud, et provoque ainsi de fortes intempéries sur l'île nord de la Nouvelle Zélande.

Commentaires :

Ivy a eu un impact très fort sur le Vanuatu. Il a concerné la quasi-totalité des îles de l'archipel en touchant tout spécialement Efate puisque l'œil est passé sur Port Vila.

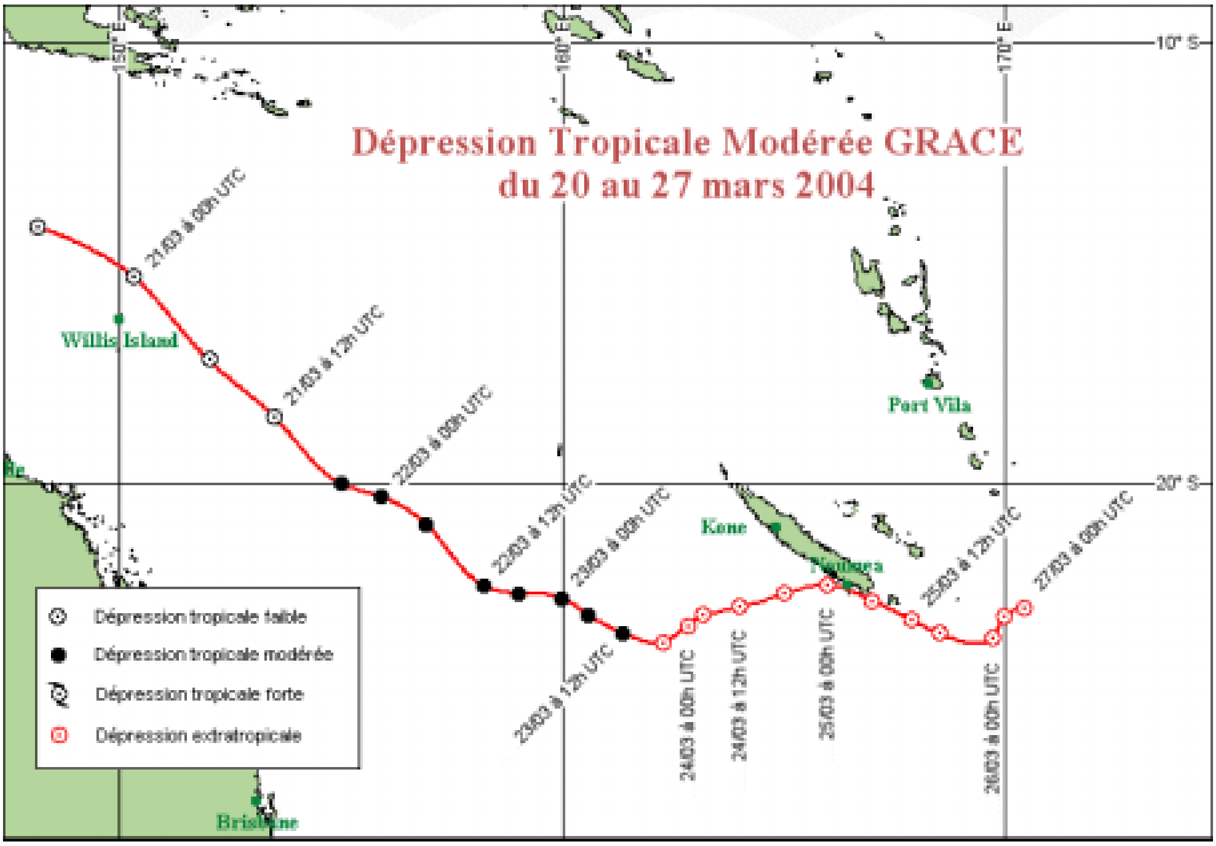
Pour la Nouvelle Calédonie, la pré-alerte est déclenchée le 24 à 10h locales lorsqu' Ivy pénètre dans notre carré de surveillance. Les trajectoires prévues amène à déclencher l' alerte 1 sur les Loyauté le 26 à 12 h locales. Le 27 l'alerte 2 est déclenchée sur les îles Loyauté et l'alerte 1 est déclenchée sur l'extrême sud de la Grande Terre. L'île des pins passe en alerte 2 le 27 en soirée, puis le 28 les alertes sont progressivement levées.

En fait Ivy passe suffisamment loin pour ne pas provoquer de fortes intempéries sur le territoire.

Les vents les plus forts ont été enregistrés à Maré avec un vent instantané de 112 km/h le 27 à 15h45 et 126 mm de pluie relevé ce jour là.

A noter tout de même que de fortes houles ont affecté les côtes des îles loyauté.

II-2 Dépression tropicale modérée Grace



Grace s'est formée sur le nord de la mer de Corail et se décale vers le sud-est se rapprochant ainsi de la Nouvelle Calédonie.

Grace est baptisée le 22 par le centre de Brisbane, elle va se maintenir 2 jours dépression tropicale modérée avec des vents maximum de 40 à 45 nœuds, mais rapidement dès le 23 les conditions deviennent défavorables et Grace va devenir extra tropicale.

Le tourbillon de basse couche va se maintenir plusieurs jours. Grace qui a suivi une trajectoire vers le sud-est se situe le 24 à 00h utc à 450 km à l'ouest sud-ouest de Nouméa. Sa trajectoire va s'incurver vers l'est et la dépression extra tropicale Grace va passer quasiment sur Nouméa le 25 et s'évacuer ensuite vers l'est de l'île des Pins et se combler complètement.

Sans provoquer de conditions extrêmes, car elle a perdu ses caractéristiques tropicales, Grace va amener un temps maussade sur le sud de la Grande terre et l'île des Pins pendant plus de 5 jours.

Commentaires :

Grace est restée dépression tropicale modérée car malgré de bonnes conditions au départ elle a rencontré rapidement des conditions défavorables en se déplaçant vers le sud-est.
En revanche on a pu suivre assez longtemps le tourbillon de basses couches.

Grace bien qu'occasionnant des conditions médiocres sur le sud de la Nouvelle Calédonie, il n'a pas été nécessaire de mettre le territoire en alerte cyclonique.

2001/2002 SEASON – TROPICAL BRIEF REPORT

(Submitted by Papua New Guinea)

Introduction

Tropical Cyclone "UPIA" formed in the waters of Eastern Milne Bay Province within the Papua New Guinea forecast area of responsibility at 4:00 a.m. on 26 May 2002 (local) and lasted until 9:00 a.m. on 30 May 2002. Following summary should briefly highlight the track it took and damages caused during its lifetime.

Summary

From the GMS IR Satellite picture, a mass of cloud near Bougainville Island was moving in a southwesterly direction. At 4:00 a.m. on 26th May 2002, the central pressure of the cyclone was estimated to be 997 hPa and positioned at 08.5S/153.3E, still moving in a southwesterly direction at 05 knots (~2.5 m/s). At 6:00 a.m. on the 26th of May 2002, the Tropical Storm had reached Tropical Cyclone strength and was named UPIA.

Summary of Tropical Cyclone UPIA given below is based on operational data.

Date (local)	Time (local)	Central pressure	Coordinates	Direction of movement	Speed (knots)
26/05/02	04:00 a.m.	997 hPa	08.5 S / 153.3 E	SW	05 kt
		TC named UPIA			
	06:00 a.m.				
	11:00 a.m.		08.6 S / 153.1 E	SW	04 kt
	05:00 p.m.	995 hPa	09.1 S / 153.3 E	SE	05 kt
	11:00 p.m.		09.1 S / 153.8 E	SE	05 kt
27/05/02	05:00 a.m.	995 hPa	09.1 S / 154.1 E	SE	05 kt
	11:00 a.m.		10.1 S / 154.6 E	SE	05 kt
		TC UPIA	based on 270300z		
	05:00 p.m.	relocated	Visible Picture		
	11:00 p.m.	995 hPa	09.2 S / 153.6 E	Stationary	
28/05/02	05:00 a.m.		09.3 S / 154.8 E	Stationary	
	11:00 a.m.		09.4 S / 153.9 E	Stationary	
	05:00 p.m.		09.9 S / 154.6 E	SE	05 kt
	11:00 p.m.		10.0 S / are.5 E	SE	06 kt
29/05/02	05:00 a.m.		10.2 S / 154.5 E	SE	05 kt
	11:00 a.m.	Ex TC UPIA	10.3 S / 155.7 E	SE	07 kt

Summary of damages

(Damage Report compiled by Mr Molemole, the Headmaster of the Budibudi Community School.)

Initially TC Upia was located at approximately 80 kilometers North East of Woodlack Island on the morning of Sunday, 26 May 2002 at 1100 hours. During the events of the same day, TC Upia intensified and moved towards Budibudi Island causing havoc and destruction during the night of the 26th May 2002 up into the early hours of Monday, 27th May 2002.

The island suffered intensely during the 12 hours ordeal on Sunday. The report indicates that all coconut trees on the island including those on the adjacent islands were flattened. A small island adjacent to Budibudi Island where people do gardening was extensively damaged by rising sea and surges during passage of TC Upia where food crops were destroyed by salt water. The island community will be without food source for a very long time after gardens were destroyed by TC Upia.

The report also indicated that 1 x church building, 6 x residential houses, 1 x smoke house and 1 x Canoe were destroyed during the event of TC Upia passage.

Fatalities

No report of deaths from Budibudi and surrounding islands.

Brief prepared by:

Tau Ray GABI
Assistant Director
Forecasting & Warning Services Department

2003 SEASON – TROPICAL CYCLONE "EPI" ANALYSIS

Tropical Cyclone "EPI" organized on the 4th June at 11:00 p.m. On Thursday 5th June at 3:47 a.m. the spirals begun to appear and initial gale and strong wind warning were issued at 09:00 a.m. By 12:00 noon the system had developed into a Tropical Cyclone and was named EPI. The Cyclone watch warning was activated and the Milne Bay Island Communities were warned through the NBC Radio of the formation of the Tropical Cyclone. The National Disaster and Emergency Office in Gurney and Port Moresby were alerted through telephone.

The forecast officers schedules were quickly revised to enable execution of a 24 hour monitoring process. Assistant Manager for Forecasting and Warning Center allocated some funds and forecasters implemented a 24-hour watch on Tropical Cyclone "EPI".

Analysis carried out yielded the following:

Figure 1: GMS Satellite Picture of Tropical Cyclone "EPI"

Figure 4: Time Series Analysis and Latitudinal Temperature Profile of TC "EPI"

Deep Convection began to occur at 041500UTC peaks at –80.0°C, at 0419:00UTC it subdued a little and peaks again at 6 042100UTC, drops below –60.0°C at 050200UTC and peaks to -85.0°C at 050300UTC. This deep convection was seen to occur near 151.5°E, peaks at 152.3°E and remained constant and subsided near 153.7°E. In less than 24 hours a system had developed into a cold core Tropical Cyclone with a warm edges and averaging 236.5 km in size and was named "EPI".

The system formed so quickly and was short lived. The affected areas are within the Solomon Sea and the Milne Bay Islands Waters. Some flooding did occur within the affected region but no reports have been received.

Figure 5: Temperature Profile Histogram and Contour

Figure 6: 24 Hour GMS Satellite Pictures of Tropical Cyclone "EPI"

Conclusion

Epi (Port Moresby) 5-6 June 2003

The analysis showed deep convection with brightness temperatures up to –80°C. The system was dense and with a weak feeding mechanism in the lower levels, the system was unable to support and maintain itself and dissipated within the 12 hours from its formation. Tropical Cyclone Epi was a very short-lived cyclone lasting for about 12 hours over the Solomon Sea. Epi formed in an area of persistent convection that extended from Papua New Guinea toward the north of Fiji. Satellite imagery shows the development of a large curved band giving the indication of a rapidly developing cyclone at 0600UTC on 5 June. However, cloud features weakened around 1400UTC when strong northeasterly upper-level winds developed over the centre. Initially, the system appeared to be moving slowly west. However, Epi then paused and moved eastwards indicating possible interaction with a strengthening low to the southeast that developed into TC Gina that contributed to Epi's demise. There was no known damage from TC Epi.

There are still no known damage to date, I contacted our National Disaster Committee person in the affected area where TC "Epi" occurred and he had told me that there was very minimal damage.

Brief pepared by: Mr Jimmy Gomoga and presented by Tau Ray GABI.

REVIEW OF THE 2003-2004 TROPICAL CYCLONE SEASON

(Submitted by Samoa)

The only event of any significant magnitude during the season apart from several synoptic scale tropical depressions which brought heavy rainfall, was Tropical Cyclone Heta that made entry into our area on 1st January 2004. A brief statement is made on the warning procedures carried out during our monitoring of the event.

Credit to all parties concerned in formulating this agreement and procedures goes to NOAA's Honolulu Weather Office, Pago Weather Services and Samoa's Meteorological Services. The Tropical Cyclone Warning plan was put to the test during this monitoring process and despite some technical communications problems experienced by our service was successful and resulted in a more improved warning system.

A report of an active tropical depression about 200 miles west of Savaii at 1200Z on the 31st December 2003, prompted discussions and the recommendation made by the Weather Forecasting unit to management to consider activation of the Tropical Cyclone Warning Plan (TCWP).

Samoa's TCWP was activated and the very first Special Weather bulletin (SWB), a GALE WATCH was issued at 1800Z or 7:00 a.m., Wednesday, December 31, 2003.

The tropical depression had developed into a tropical cyclone and was named by RSMC Nadi as "Heta". It moved north towards the Tokelau Islands before it recurved south.

A GALE WARNING SWB (8) was issued at 030000Z or 1:00 p.m., Friday 2nd, January, 2004 when Tropical Cyclone Heta was about 307 miles west of Savaii.

A STORM WATCH SWB (14) was issued for Savaii at 031200Z or 1:00 a.m., Saturday morning, 3rd January, 2004 and gale warnings remain enforced for the rest of Samoa.

A STORM WARNING SWB (20) was issued for Savaii (western side) at 040600Z or 7:00 p.m., Saturday evening.

A STORM WARNING SWB (23) was issued for the rest of Savaii at 041500Z or 4:00 a.m., Sunday 4th.

A HURRICANE WARNING SWB (24) was issued for the rest of Samoa at 041800Z or 7:00 a.m. Sunday morning.

A HURRICANE WARNING SWB (31) was CANCELLED for the rest of Samoa at 051800Z or 7:00 a.m. Monday morning, 5th January 2004 but the STORM WARNING was still enforced.

A STORM WARNING CANCELLED SWB (35) for the rest of Samoa at 060300Z or 4:00 p.m. Monday afternoon GALE WARNING remains enforced.

A GALE WARNING CANCELLED SWB (36) for the rest of Samoa at 060900Z or 10:00 p.m. Monday evening WND ADVISORY was still in effect.

The monitoring officially ended on Monday 6th January 2004. This was relayed to the National Disaster Management Council the following day, Tuesday, 7th January at its disaster response meeting.

Tropical Cyclone Heta continued in its southeast path and eventually devastated the island of Niue.

Associated phenomena reported were storm surges which hampered infrastructure(particularly the coastal roads) strong winds downed power lines and flooding destroyed culverts. To a lesser extent, moderate damage due to flooding during the event have been reported. The most affected sector was agriculture and it was estimated that recovery could take at least eight to ten months.

FUNCTIONING OF THE CYCLONE WARNING SYSTEM IN SOLOMON ISLANDS

(Submitted by Solomon Islands)

Period 2002-2003

Two major cyclones devastated the southern parts of Solomon Islands, namely tropical cyclone Zoe, the strongest system ever recorded in this region since the use of satellite imagery for monitoring purposes and tropical cyclone Beni. The warnings for the two cyclones were disseminated using the facilities of the Civil Aviation and the National Disaster Management Office's facilities otherwise we would have been in a catastrophic situation. In the case of cyclone Zoe, we knew only of the system when the national radio broadcasted the initial advisory following an arrangement we made with TCWC Brisbane. Otherwise there would be total chaos.

Period 2003-2004

This period was very quiet except for a few tropical lows developing in the vicinity of the country, one of these lows later developed into cyclone Ivy which affected Vanuatu and another developed into a rain depression which went through Fiji in April and caused a lot of flooding and deaths.

PLEASE SEE THE WMO/TROPICAL CYCLONE PROGRAMME WEB SITE FOR

PRESENTATIONS MADE BY MEMBERS IN POWERPOINT FORMAT

APPENDIX VI

RA V TROPICAL CYCLONE COMMITTEE'S TECHNICAL PLAN AND ITS IMPLEMENTATION PROGRAMME (2004-2006)

Items	PR	Objectives	Strategies	Key Stakeholders	Funding Source/s	Critical Success Indicator	Focal Point	Remarks
Marine Meteorology workshop for operational forecasters	1	To improve operational marine forecasting skills for ocean and coastal areas	To conduct a workshop on forecasting waves/swells/storm surge	All Members	JCOMM	Workshop held		Coordinated by WMO and SPREP. To include training in the use of existing wave models
Satellite Technologies	2	To replace existing WEFAX receiving systems with new LRIT receiving systems	To evaluate and acquire suitable receiving systems	Members dependent on requirements	SPREP and WMO to secure funding	Completion of installations before WEFAX transmission ceases	SPREP/WMO	
Attachment Training	3	To familiarize forecasters with RSMC Nadi, TCWC Brisbane and RSMC Honolulu tropical cyclone warning operations and procedures	To attach forecasters from Members to either RSMC Nadi, TCWC Brisbane or RSMC Honolulu (Pacific Desk)	All Members	WMO, USA	3 visits		Coordinated by WMO and SPREP
Wind Damage scale	4	To provide a wind damage scale to the Southwest Pacific islands	To transfer the North Pacific STiCkS technique to the Southern Hemisphere	Southwest Pacific islands, Dr Chip Guard and Mr Mark Lander		Delivery of a S.H. version of the Users Manual. Workshop held	RSMC Nadi, TCWCs and Mr Chip Guard	

Items	PR	Objectives	Strategies	Key Stakeholders	Funding Source/s	Critical Success Indicator	Focal Point	Remarks
Automatic Weather Stations	5	To improve AWSs maintenance capability To expand a sustainable AWS network in the Pacific Region	To organize an AWS maintenance course in French Polynesia To support Pacific GCOS program	All Members SPREP		Success of course and number of operational AWS	French Polynesia	French Polynesia offered to host an AWS maintenance course
Satellite product interpretation training	6	To improve the operational skills of tropical cyclone forecasters on satellite-derived products.	To conduct a satellite applications Workshop	All Members		Workshop held	Australian Bureau of Meteorology	Complementary radar information training where applicable
Emergency Communications	7	To ensure Members have back-up communications during severe weather events	To provide suitable emergency communication systems	All Members		Improved emergency communications	Communications Committee/ RANET	eg, satellite phones, SW radio receivers, HF transceivers

Items	PR	Objectives	Strategies	Key Stakeholders	Funding Source/s	Critical Success Indicator	Focal Point	Remarks
RANET	8	Improve remote community access to hydro-met and climate information: eg observations, forecasts, warnings, etc. Improve communication and dissemination capacities of NMHSs Facilitate feedback and input from remote communities to NMHSs	Promote local ownership and involvement Develop, invest in, and demonstrate satellite and terrestrial broadcast technologies that are sustainable and appropriate to their use and placement Establish broad partnerships with development and disaster response organizations external to NMHS community	All Members	Utilize existing support from NOAA and USAID Mobilize new resources where needed (AusAid/ NZAID)	RANET Steering Committee to develop a plan for specific activities by Dec. 2004 Successful implementation of plan for pilot activities and country programs Integration and improvement of various communication platforms Status reports and updates to all members	RANET Communications Committee	
Mentor Training	9	To improve the tropical cyclone forecasting capability of members	To conduct mentoring missions	Members who have not yet benefited from the program	To secure funding	Minimum of 2 Members	Chairman RAV/TCC	
RAV TCC Contingency Trust Fund	10	To establish an RAV TCC contingency trust fund	Establish trust fund by 2006	All Members	All Members	Existence of fund and contributions from Members	Chairman RAV/TCC and Mr Ven Tsui	Chairman to obtain sample template from Regions with trust fund

Items	PR	Objectives	Strategies	Key Stakeholders	Funding Source/s	Critical Success Indicator	Focal Point	Remarks
Comprehensive review of the TCOP	11	To update, restructure and translate into French the TCOP	The Sub-Committee* to progress the review through email exchange	All Members		Advanced draft completed by November 2005	Chairman RAV/TCC	
Climate Research	12	To better understand the impact of climate variability and climate change on tropical cyclones	Yuriy Kuleshov to provide Members with research results on climate variability and climate change, and impact on TC activity	All Members		Research findings presented to relevant meetings and conferences	Australian Bureau of Meteorology National Climate Centre	Australian NCC to compile S.H. tropical cyclone archive and make it available to all members
Support Student Tropical Cyclone Research	13	To encourage university science students to undertake tropical cyclone projects	To promote participation by science students	All Members	To secure funding	Number of science students supported		
Operational Research	14	To better understand and improve intensity forecasting (for example, midgets and rapidly developing tropical cyclones)	To assess and evaluate existing and newer techniques (with the assistance of JTWC) RA V applied research units to continue projects aimed at improving intensity forecasting	All Members		Research findings and technique applications distributed to Members		Australia, New Zealand, France and USA to source available information

Items	PR	Objectives	Strategies	Key Stakeholders	Funding Source/s	Critical Success Indicator	Focal Point	Remarks
Sixth International Workshop on Tropical Cyclones (IWTC-VI) in 2006	15	To improve forecaster knowledge on tropical cyclones, and to participate in working groups preparing for IWTC-VI	To secure funding for suitably qualified operational forecasters to attend the workshop	All Members		8 to 10 operational forecasters (from Members) to attend IWTC-VI		Coordinated by WMO, SPREP and Australia Participants to submit a brief report to the Chairman on what was achieved at the IWTC-V Chairman to present a synopsis of the reports to the next RA V/TCC session
Bilateral Cooperation between Indonesia and Australia	16	To upgrade Indonesia's forecasting and warning capabilities to enable them to provide International Marine Warnings in their AOR	Australia to assist in improving the forecasting and warning system in Indonesia	Australia and Indonesia	Australia	Indonesia's capacity to assume responsibility for 2006/2007 season		

ACRONYMS:

AOR – Area of Responsibility
AWS – Automatic Weather Station
JCOMM – Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology
NMHS – National Meteorological and Hydrological Service
NOAA – National Oceanic and Atmospheric Administration
ONR – Office of Naval Research
PR – Priority Rating

SOPAC – South Pacific Applied Geoscience Commission
SPREP – South Pacific Regional Environment Programme
LRIT - Low Rate Information Transmission
WEFAX – Weather Facsimile
StiCkS – Saffir-Simpson Tropical Cyclone Scale

*Sub-Committee : Steve Ready, Jim Davidson, James Weyman, Rod Stainer, Yuriy Kuleshov, Rajendra Prasad, Alipate Waqaicelua.

APPENDIX VII

STATUS REPORT OF SATELLITES (APPLICABLE FOR THE RA V REGION)

1. The Fourteenth WMO Congress, held in May 2003, recalled the agreement by the Executive Council at its fifty-third session to expand the space-based component of the GOS to include appropriate R&D environmental satellite missions. That decision was a landmark decision in the history of WWW. Congress noted that the space-based component of the GOS was now comprised by satellites of three types: operational meteorological polar-orbiting, and operational geostationary satellites and environmental R&D satellites. In recognition of the critical importance for data, product and services provided by the WWW's expanded space-based component of the GOS to WMO Programmes and supported Programmes, and that such importance would continue to expand rapidly, the Fourteenth WMO Congress decided to initiate the WMO Space Programme as a major crosscutting Programme to increase the effectiveness and contributions from satellite systems to WMO Programmes.

2. For the RA V region during 2003, the space-based constellation was comprised of the following geostationary and polar-orbiting satellites: GOES-9, GOES-10, NOAA-16 and NOAA-17 operated by the United States; METEOR-3M N1 and METEOR-3 N5 operated by the Russian Federation (although METEOR-3M N1 suffered a severe reduction in capability in late 2003); GMS-5 operated by Japan; Meteosat-5 and Meteosat-8 (formerly MSG-1) operated by EUMETSAT; and FY-2B, FY-1D operated by China. There were several satellites launched in 2003. NASA launched ICESat and SORCE in January, NOAA launched DMSP F-16 in October, and CAST launched CBERS-2 in October. Most space agencies contributing operational polar-orbiting and geostationary satellites have in place contingency plans for satellite systems that guarantee the continued daily flow of satellite data, products and services WMO Members have come to depend on. In that regard, Japan and the United States of America initiated a back-up operation of GMS-5 with GOES-9 on 22 May 2003.

3. With regard to the R&D constellation, the following participating agencies and missions in the constellation included: NASA's Aqua, Terra, NPP, TRMM, QuikSCAT and GPM missions; ESA's ENVISAT, ERS-1 and ERS-2 missions; JAXA's ADEOS II and GCOM series; Rosaviakosmos's research instruments on board ROSHYDROMET's operational METEOR-3M N1 satellite, as well as on its future Ocean series and CNES's JASON-1 and SPOT-5.

The following reports provide more detailed information.

EUMETSAT

4. EUMETSAT is currently operating four satellites, Meteosat Second Generation (Meteosat-8), Meteosat-7, 6 and 5. As of September 2003, the 0° Service is provided by Meteosat-7, with Meteosat-6 as an in-orbit spare, supporting the Rapid Scan Service, at around 10° East. Meteosat-5 is located over the Indian Ocean at 63°E and provides the Indian Ocean Data Coverage (IODC) Service. On 29 January 2004 the first Meteosat Second Generation satellite MSG-1, renamed Meteosat-8, commenced routine operations. Details of Meteosat Operations can be found at the EUMETSAT Web site: *http://www.eumetsat.de*

Meteosat-5

5. Meteosat-5 has been used in support of the Indian Ocean Data Coverage service since the formal start of EUMETSAT support to the INDOEX experiment on 1 July 1998. No DCP or MDD services have been provided via Meteosat-5. The orbital inclination of the satellite at the end of this reporting period was 6.01° and increasing. The remaining hydrazine fuel on board is estimated to be 4.95 kg, of which a 4kg reserve will be required to de-orbit the spacecraft at the end of its useful life. The on-board fuel reserve limit of Meteosat-5 will be re-evaluated towards the end of 2004.

Meteosat-8 (MSG-1)

6. On 29 January 2004 the first Meteosat Second Generation satellite MSG-1, renamed Meteosat-8, commenced routine operations.

EUMETCast Dissemination

7. As part of the preparations for routine operations of MSG-1 (renamed Meteosat-8 for routine operations), a data dissemination trial using EUMETCast commenced on 30 April 2003. The trial will continue until the start of routine operations, with dissemination products being progressively added. Users who intend to utilize the data during routine operations are invited to participate in this trial. Full details can be found on the EUMETSAT Web page together with relevant technical documentation.

Russian Federation

Status of Russian Polar Orbiting Meteorological Satellite System

8. The first polar orbiting satellite METEOR-3M N1 of the new series of meteorological satellites was launched on 10 December 2001. METEOR-3M N1 operates at circular sun-synchronous orbit inclined at 99.6 degrees with 09:15 a.m. ascending node (morning orbit). The payload of METEOR-3M N1 includes the scanning instrument MR-2000M (0.5-0.8 μm), scanning IR radiometer KLIMAT (10.5-12.5 μm), MW scanning radiometer MIVZA (5 channels in the range 20-94 GHz), MW conical scanning radiometer MTVZA (20 channels in the range 18.7-183.3 GHz), high resolution scanning instrument MSU-E (3 channels in the range 0.5-0.9 μm with spatial resolution 38 m), UV–band instrument SFM-2, complex of heliogeophysical instruments (KGI-4C, MSGI-5EI) and sensor SAGE–III (USA, NASA). Radiometers MIVZA and MTVZA have limited capabilities, due to technical problems related to these instruments scanning mode. Due to failure of the on-board 466 MHz transmitter, the satellite has limited capabilities for MR-2000M and KLIMAT data direct broadcast. Meteor-3M N1 data direct broadcast in raw format is carried out in 1.7 and 8.2 GHz bands.

Future Polar Orbiting Meteorological Satellites METEOR-3M

9. Russia is now developing a new series of polar orbiting meteorological satellites. The first polar orbiting satellite of this series, namely METEOR-3M N1, was successfully launched in December 2001. The next satellite of this series scheduled to be launched in 2006 is designed for providing operational hydrometeorological and heliogeophysical information. The primary mission objectives of METEOR satellites are quite similar to those specified for NOAA and EPS/METOP satellites. In order to meet the requirements of the users (mainly in the field of operational meteorology and climate monitoring) the future METEOR spacecrafts being launched on sun-synchronized orbit will carry as mandatory payload the imagers of visible (VIS), infrared (IR) and microwave (MW) range as well as IR and MW atmospheric sounders.

10. In summer 2002 the original satellite sketching design was seriously revised. It is proposed to develop and to launch two satellites on the base of a unified and rather heavy platform (of «Resurs» type) with a suite of operational and experimental instruments. Both of these satellites should provide the flight demonstrations of key systems and be the predecessors of operational and complete METEOR satellite. Moreover, both new spacecrafts will be equipped with supplementary instruments. In particular, it is planned to develop the locator (radar) "Severjanin" and multichannel optical scanning device KMSS of medium resolution (~ 100 m) on board the first new satellite. The implementation of these instruments should ensure substantial extension of forthcoming METEOR mission objectives.

Future Geostationary Meteorological Satellites GOMS/Electro N2

11. The next geostationary meteorological satellite GOMS/Electro N2 development continues. The tentative launch date of GOMS/Electro N2 satellite is 2006. The satellite will be placed into geostationary orbit at 76°E. The spacecraft will be a three-axis stabilized platform.

Future Russian Research and Development Satellites

12. Three new Russian R&D satellites MONITOR-E, SICH-1M and RESURS-DK are planned to be launched in 2004 to meet requirements of up to data technologies. The satellite MONITOR-E №1 is destined for environmental and land monitoring in regional scale. The satellite will operate in the sun-synchronous circular orbit at an altitude about 540 km.

NOAA/NESDIS

NOAA-17

13. NOAA-17 was launched on 24 June 2002. As of 15 October 2002 NOAA-17 was designated operational. It replaced NOAA-15 as a primary spacecraft. As such, it operates in an orbit with a 10:17 a.m. ascending node (morning orbit) and utilizes a Solar Backscatter Ultraviolet Spectral Radiometer (SBUV).

NOAA-16

14. NOAA-16 was launched on 21 September 2000. By March 2001, NOAA-16 was designated as the operational replacement for NOAA-14. As such, it operates in an orbit with a 13:53 p.m. ascending node (afternoon orbit) and utilizes a similar set of instruments as NOAA-17.

NOAA-15

15. NOAA-15 was launched on 13 May 1998 and became operational in July 1998. As of 15 October 2003, NOAA-15 was designated as a secondary spacecraft.

Standby Spacecraft

16. NOAA-14 was launched in December 1994. Although the AVHRR is performance is not reliable, it could be used to satisfy afternoon mission data requirements. NOAA-12 was launched in May 1991. Its AVHRR could be used to satisfy morning mission user data requirements. NOAA-11 was launched in September 1988. As of May 2003, it has been designated a non-operational spacecraft. NOAA-10 was deactivated on 30 August 2001 due to failure in the power sub-system.

GOES-10

17. GOES-10 is the operational West Coast satellite at 135°W. Shortly after launch in April 1997, GOES-10 suffered a near-fatal anomaly when its solar array stopped moving, either due to a gear train jam or due to an external jam. The anomaly was studied over a period of months, and it was decided to invert the satellite (180 degrees in relation to the Earth) and run the array drive in the reverse direction to track the sun. This operational strategy was coupled with extensive ground and spacecraft software modifications to allow the imagery to look “non-flipped” to the users.

GOES-9

18. Launched in May 1995, GOES-9 is stationed over the western Pacific Ocean at 155°E to provide operational data until Japan launches the next MTSAT satellite. GOES-9 was put into storage mode in anticipation of imminent wheel failure. GOES-9 has limited capability due to attitude limitations and imager visible noise, but continues to provide useful data over the western Pacific.

GOES-8

19. GOES-8, launched in April 1994, was moved to 165°E as a backup to GOES-9. The first of the series, GOES-8 retains the ability to provide the full range of products, although it’s some loss of redundancy of backup systems.

CMA

Polar Orbiting Satellites, FY-1C and FY-1D

20. The polar orbiting meteorological satellite FY-1D was launched at 9:50 (Beijing Time-BT) on 15 May 2002 from TAIYUAN Satellite Launch Center. At 10:35 (BT), the Urumuqi Meteorological Satellite Ground Station received the first image from FY-1D. After an in-orbit check, FY-1D became fully operational. The satellite is working well up to now.

21. The polar orbiting meteorological satellite FY-1C was launched on 10 May 1999. This three-axis stabilized satellite has been operating for more than 4 years. FY-1C has been operating for more than four years, exceeding the design lifetime of two years. The satellite is currently operating well.

Geostationary Satellites, FY-2A, FY-2B, and FY-2C

22. FY-2B is the second Chinese geostationary meteorological satellite. It was launched on 25 June 2000 with Long-March 3 vehicle from Xichang Satellite Launch Center. The satellite is spin-stabilized and is stationed at 105°E. On 1 January 2001, the FY-2B was put into operation and started broadcasting S-VISSR and WEFAX images. The SOCC (Satellite Operation and Control Center) controls the operation of the ground system. The system is scheduled to automatically acquire VIS, IR, and WV raw data. After being registered at the IAS (Image Acquisition System) of CDAS (Command and Data Acquisition Station), the S-VISSR images are generated and retransmitted to users via FY-2B.

23. The first Chinese geostationary meteorological satellite FY-2A was launched on 10 June 1997. On 17 June 1997 FY-2A was located at 105°E. On 26 April 2000, FY-2A was moved to the position 86.5°E to make room for FY-2B. On 27 July 2000 the check out for FY-2A showed that after 3 years in orbit the FY-2A satellite system remained in good condition except for the S-band antenna that cannot be allowed to work long hours everyday. The observation instrument was switched from system A to system B (redundancy) in the process, then the system B was checked out thoroughly. The results showed that system B works as well as system A. During the interruption of FY-2B transmission, a contingent plan was implemented to allow the FY-2A to work 4 hours a day in order to replace FY-2B in case the latter cannot be recovered. A test was made on FY-2A, during which, FY-2A transmitted 6 full disk images, undertook the turn around ranging 3 times. Since the FY-2B is recovered, FY-2A is closed. FY-2A will be closed as long as FY-2B works everyday. The ground system only makes the orbit control and the eclipse management. The geostationary meteorological satellite FY-2C will replace FY-2B. It is planned to launch FY-2C in 2004.

Development of FY-3A Meteorological satellite

24. FY-3 is the second generation of Chinese polar orbiting meteorological satellite. This series includes 7 satellites to be operated during the period 2006-2020. The first two satellites FY-3A and FY-3B and the onboard instruments are being designed and manufactured. Payloads onboard FY-3A are the imaging mission payload: (1) Visible and Infrared Radiometer (VIRR), (2) Medium Resolution Spectral Imager (MERSI), (3) Microwave Radiation Imager (MWRI) and the sounding mission payload: (1) Infrared Atmospheric Sounder (IRAS), (2) Microwave Temperature Sounder (MWTS), (3) Microwave Humidity Sounder (MWHS), (4) Total Ozone Unit and Solar Backscatter Ultraviolet Sounder (TOU/SBUS).

25. FY-3A is to be launched in 2006. Design schemes for all sub-systems of FY-3A and payload have passed the examination and evaluation phase. Prototypes in phase B are being designed and manufactured to prove the design schemes, and to prepare for the electrical interface matching experiments among all subsystems at the same time.

JMA

Current Status of GMS-5

26. GMS-5 has been operated at 140°E on the geostationary orbit since 21 June 1995 far exceeding its designed lifetime of 5 years. Although the VISSR observation was discontinued on 22 May 2003 as the back-up operation with GOES-9 started, GMS-5 has been steadily disseminating WEFAX produced from GOES-9 observations and relaying DCP data.

27. In order to avoid the risk of the expected high motor-torque of scanning mirror caused by the growth of lubricant build-up at the motor roller bearing, JMA had conducted countermeasures such as reduction of the observation frame, changes of some Full Disk observations to Northern Hemisphere observations in June 2000 and July 2001. These countermeasures and careful VISSR operations had successfully controlled the lubricant build-up under a safe level until the beginning of the back-up

operation. Since the discontinuation of the VISSR observation, the scanning mirror has been stationed at a fixed point and there has been no sign of degradation of the lubricant build-up around that point.

Status of Backup Operation of GMS-5 with GOES-9

28. JMA started backup operation of GMS-5 with GOES-9 on 22 May 2003 in cooperation with NOAA/NESDIS to ensure continuous earth observations over the western pacific. JMA discontinued the observations with GMS-5 and initiated the utilization of GVAR data obtained from GOES-9 operated by NOAA/NESDIS at 155°E above the Equator. Since then, JMA has produced the meteorological products such as atmospheric Motion Vectors (AMVs) from the GVAR data, and provided users with the WEFAX pictures and the Stretched-VISSR (S-VISSR) data converted from the GVAR data. The backup operation with GOES-9 will be continued until MTSAT-1R, the successor to GMS-5, will start its normal operation.

29. The WEFAX pictures converted from GVAR data are disseminated to Small-scale Data Utilization Stations (SDUSs) via GMS-5 stationed at 140°E. Users of WEFAX are able to obtain those pictures using existing facilities without any modification.

30. The broadcasting service of S-VISSR data via GMS-5 was discontinued when the backup operation started. In place of S-VISSR dissemination via GMS-5, S-VISSR type data files are being disseminated to registered National Meteorological and Hydrological Services (NMHSs) through the Internet/FTP server of JMA. At present, only IR1 (10.5-11.5(μm) channel data is provided, and registered NMHSs are permitted to access the server. S-VISSR type data files are posted on the server in 10-15 minutes after finishing observation from GOES-9.

INDIA

Status of INSAT and KALPANA-I (METSAT)

31. INSAT is an operational multipurpose satellite system catering to the requirements of three different services, viz Television & Radio Broadcasting, Communications and Meteorology. The INSAT project is a joint venture of the Department of Telecommunications (DOT), the India Meteorological Department (IMD), Doordarshan and All India Radio (AIR). The responsibility for overall management and coordination of the INSAT system among the user agencies rests with the INSAT coordination committee (ICC).

32. The 2nd generation of INSAT satellites (INSAT-2 series) were started from July 1992 with the successful launch of the first satellite of the series (INSAT-2A) on 10 July 1992. The 2nd satellite of INSAT-2 programme i.e., (INSAT-2B) was also launched successfully on 22 July 1993. All INSAT satellites are three-axis body stabilised spacecrafts. The last satellite of INSAT-2 series i.e., INSAT-2E was launched successfully on 3 April 1999 and was made operational from May 1999. It has a new payload, called Charged Coupled Device (CCD) camera capable of taking 1 km resolution images in 3 bands. The meteorological imaging capability in thermal IR Band has also been upgraded on this satellite, as compared to its predecessors, by providing a water vapour channel with 8 km resolution in the VHRR, the imaging instrument of the satellite. However, VHRR onboard INSAT-2E is not working due to an anomaly in the scan-mechanism. A dedicated Meteorological Satellite METSAT (Kalpana-I) was launched by India in September 2002 for earth imaging with three channel Very High Resolution Radiometer (VHRR). A Data Rely Transponder (DRT) for collection of meteorological and hydrological data from automatic weather stations has also been provided on this satellite. METSAT has been operational from 24 September 2002.

33. The first satellite (INSAT-3A) with meteorological payloads, of 3rd generation of INSAT satellites (INSAT-3 series) was launched on 10 April 2003. Its meteorological payloads are identical to those of INSAT-2E i.e., a 3-channel VHRR and a 3-channel CCD. INSAT-3A has also a data Relay Transponder. The satellite has been declared operational from May 2003.

Current operational status

34. The imaging mission is working satisfactorily with the METSAT (Kalpana-I) satellite and INSAT-3A

and they continue to be used operationally. High-resolution (1km) images in 3 channels are also available operationally from INSAT-3A and INSAT-2E CCD cameras. Activities such as image processing, derivation of meteorological products, data archival and dissemination of products to field stations for operational use are being done on a routine basis.

35. VHRR images are normally received at three-hourly intervals. More frequent images are taken for monitoring the development of special weather phenomena as and when the situation demands. CCD images from INSAT-3A are also being taken every three hours for operational use during the daytime. More frequent images are taken if the situation demands. For the derivation of CMVs half hourly triplets at 00 UTC and 12 UTC are also received from INSAT-A and data processed. The INSAT derived CMVs are being disseminated operationally to the users through GTS.