SEVERE WEATHER FORECASTING AND DISASTER RISK REDUCTION FULL DEMONSTRATION PROJECT (SWFDDP)

REGIONAL SUBPROJECT RA V

PROGRESS REPORT N° 2

For the period 1 Mar 2011 – 30 June 2011

(15 Aug 2011)

Part of SWFDDP website banner

1 Overview:

1.1 Introduction:

The meeting of the Regional Subproject Management Team (RSMT) of the RA V Severe Weather Forecasting and Disaster Risk Reduction Demonstration Project (SWFDDP) for the planning of the expansion of the Regional Subproject to include nine South Pacific Islands was held from 1 to 4 November 2010, in Wellington, New Zealand. The meeting report can be found at:

Meeting of the Regional Subproject Management Team (RSMT) of the SWFDDP - South Pacific Islands, Wellington, New-Zealand, 1-4 November 2010

Based on the success of the Pilot phase of the SWFDDP (1 November 2009 to 31 October 2010), it was concluded that the RSMT will implement a full Demonstration Phase with expanded participation, from 1 November 2010 to 31 October 2012.

The Regional Subproject Implementation Plan (RSIP) can be found at:
Regional Subproject Implementation Plan (RSIP) for the full phase of the SWFDDP - South Pacific Islands (pdf)

The principles and the goals of the Project were well outlined in section 1.1 of the plan. The Cascading Forecasting Process of global centres providing products through a lead RSMC to NMHSs is described in section 1.2. The overall framework of the Project in RA V is presented in section 1.3.

Full demonstration phase participants:

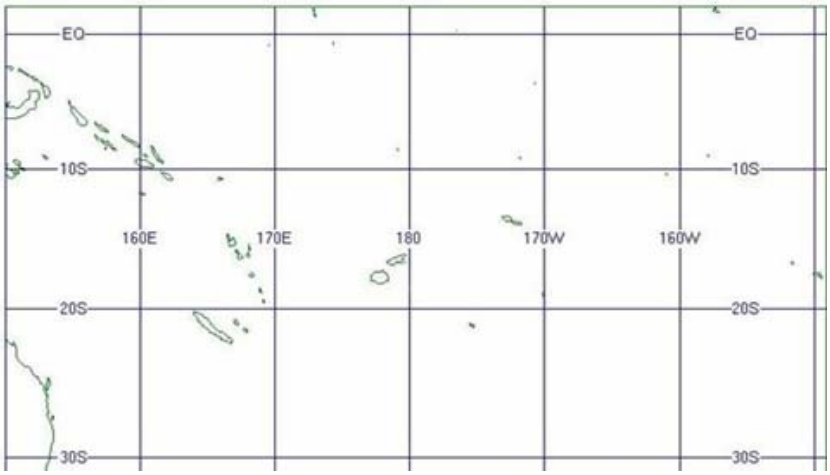
A Pilot phase involving a group of 4 participating countries in 2009/10 (Samoa, Vanuatu, Solomon Islands, and Fiji) was completed on 31 October 2010. It is followed by a full Demonstration phase in 2010/12 which includes the 4 Pilot phase NMHSs plus the following five NMHSs: Cook Islands, Niue, Kiribati, Tonga and Tuvalu.

The Regional centres include: RSMC Wellington as lead RSMC for this Subproject (having responsibility for the development and management of a dedicated project Portal), RSMC Darwin (Geographic), and RSMC Nadi (Activity – Tropical Cyclone Centre (TCC)). Fiji also participates in the project as a NMHS.

The Global centres (ECMWF and the Met Office UK) will continue to participate actively. The Met Office has tailor made products for the area 150E – 120W, 10N – 40S, which is larger than the 'South Pacific window' - 150E - 150W, 2N -30S of the RSMC Wellington Guidance product (see below).

In section 2.4, the current or pending contributions of Japan (JMA),USA (NCEP and Honolulu) and France (Météo-France in French Polynesia and New Caledonia) to the Project is outlined.

SWFDDP 'South Pacific Window' (subset of the above map)



South Pacific Ocean Map (showing location of participating NMHS)

This second Progress Report of the full Demonstration Project spans the period 1 March 2011 to 30 June 2011. This progress report compiles and assesses the feedback received from the RSMCs and the NMHSs in order to determine the quality of the guidance provided by RSMC Wellington as well as the quality and applicability of the global and regional products available. The feedback will also be used in order to ascertain the relevance and the quality of the warnings issued and improvement of the warning services the NMHSs delivered to the Disaster Management and Civil Protection Authorities – "DMCPA" and to the media.

The five newest additions to the list of participating countries viz Kiribati, Tuvalu, Tonga, Niue and Cook Islands depend on RSMC Nadi for some or all of their forecasts and warnings. This poses a challenge in how such forecasts and/or warnings should be evaluated when they are issued by somebody else. Each country should accept some degree of responsibility for what goes out to their public and if it isn't happy with any of the contents, they should feedback their ideas to RSMC Nadi. This way it makes sense for each of them to evaluate the forecasts and warnings just as if they had produced them.

SWFDDP News:

The MetService has just secured funding from the New Zealand Ministry for the Environment to support training for the SWFDDP. This is from a NZ Climate Change Development Fund, in recognition that severe weather forecasting and its impacts is part of an overall strategy of adapting to climate change.

The funding will cover travel costs for two MetService trainers, for several days of in-country training to each of the nine countries now involved in the Demonstration phase of the SWFDDP. MetService's in-kind contribution will be the staff's time.

For logistical reasons, and in order to properly prepare for the training, most of the in-country visits are planned to take place in 2012 outside the tropical cyclone season - roughly in the period from May to October 2012.

The input from members of the RSMT is most welcome.

Reports and feedback received from participating RSMCs and NMHSs for the period 1 March 2011 – 30 June 2011 (**Boldface:** Pilot phase participants)

Centre/Country	Event report (Appendix H)	Evaluation table(Appendix I)	Verification of warnings	Case studies[3]
RSMC Wellington	x	n/a	[1]	
RSMC Darwin	x	n/a	n/a	
RSMC Nadi	X[0]	n/a	n/a	
NMHS Samoa	missing	Monthly reports[4]	[2]	
NMHS Solomon Is.	x	x	[2]	
NMHS Vanuatu	x	x	[2]	
NMHS Fiji/Nadi	X[0]	x	[2]	
NMHS Cook Is.	x	x	[2]	
NMHS Kiribati	x	x	[2]	
NMHS Niue	x	x	[2]	
NMHS Tonga	x	x	[2]	
NMHS Tuvalu	x	x	[2]	

X[0] NMHS Fiji sent in a progress report that referred to some RSMC activities.
[1] RSMC Wellington has begun verification of the South Pacific Guidance as outlined in this report
[2] No NMHS has presented formal verifications of their warnings yet
[3] No NMHS has presented a case study for the period; Cook Islands presented a series of exchanges for the 6-8 May 2011 swell event
[4] Samoa submitted a series of Appendix I 's on a monthly basis

2. Input from RSMCs and Global centres:

2.1 RSMC Wellington:

As the lead RSMC for this project, Wellington continued to provide a platform (MetConnect Pacific at **www.swfddp.metservice.com**) for the SWFDDP products. This web site also provides helpful background material and links to global centres, other RSMCs and the NMHSs. Twice daily the RSMC staff produces the RSMC Daily Severe Weather Forecasting Guidance Products, referred to as the "South Pacific Guidance (SPG)" charts.

As agreed in the Implementation Plan, as of 1 December 2010 the threshold criteria used to generate the SPGs were changed. The new criteria provide more realistic thresholds in terms of what ranks as a severe weather event and taking into account the vulnerabilities of low-lying islands. The criteria thresholds for rain, wind and waves were raised to: rain ≥ 100mm/24hrs, winds ≥ 30 knots and waves ≥ 2.5m north of 15S, and ≥ 3.5m at and south of 15S.

From 1 March 2011 to 30 June 2011, a total of 1215 South Pacific Guidance charts were produced by RSMC Wellington Lead meteorologists and posted on MetConnect Pacific. 949 (about 78%) of these charts contained guidance. Of the charts containing

guidance 847 were for large waves (nearly 90%), followed by heavy rain 446 (about 50%). 266 charts (about 22%) displayed NIL SIG (refer to Table in 6.4).

MetConnect Pacific: The website operated continuously with no outages throughout this reporting period (1 March 2011 to 30 June 2011).

2.2 RSMC Darwin:

RSMC Darwin continued to contribute regional NWP guidance and tropical climate monitoring products during the full demonstration phase of the SWFDDP-RAV demonstration phase from 1 March to 30 June 2011.

Additional Bureau of Meteorology support for the SWFDDP-RAV was provided in the form of in-country training on 'Tropical Cyclone Module' software for forecasters at the Meteorological Services in Fiji, Samoa, Tonga and Vanuatu between February and April, 2011, funded by AusAID.

The final testing of automated vortex tracking within the tropical ACCESS NWP models is in progress, and testing of ACCESS-TC, the moveable-domain high-resolution tropical cyclone is continuing on northern hemisphere tropical cyclones. ACCESS-TC and vortex tracking are expected to be ready for operations before the 2011/12 tropical cyclone season.

Parallel trials of an upgraded version of the ACCESS NWP model suite (the Australian Parallel Suite 1 - APS1) will be commenced soon, in preparation for implementation later in 2011. Upgrades include the replacement of the tropical model ACCESS-T with a 12 km resolution regional model, ACCESS-R12.

2.3 RSMC Nadi

RSMC Nadi (TCC) continued to provide access to its web site through MetConnect Pacific.

2.4 Products from global centres*:*

ECMWF The ECMWF products continued without interruption through this time period and were well received by the forecasters. A “Global EFI all parameters” interactive chart is only available to member states but not the SWFDP community at this stage. There is also a new tropical cyclone genesis product that is available but not under SWFDDP login.

Met Office UK: The Met Office’s products continued without interruption throughout this time period.

JMA: Since the previous report, JMA is now providing ensemble wind and rainfall products on MetConnect Pacific in addition to the deterministic model data. The MTSAT image highlighting “Heavy rainfall potential areas” continues to be a useful product in the absence of radar in all participating countries except Fiji.

Other centres:

RSMC Wellington is working closely with Ray Tanabe, new Director of the Central Pacific Hurricane Center about USA progress in getting the WRF model to run over the South Pacific area. It's still a work in progress. The USA have set up a special page for the SWFDDP area containing a range of deterministic fields which can be accessed under Global (NCEP) on MetConnect Pacific.

There has not been any further development with Météo-France (French Polynesia, New Caledonia) in obtaining model data.

3. Summary of the severe weather events 1 March to 30 June 2011

3.1 Severe Weather Events reported by RSMC Wellington:

Tropical cyclones

Bune was named on 24 March UTC, located east of the Fiji Islands. The cyclone deepened as it moved south, crossing into Wellington's area of responsibility on 27 March UTC. Bune then passed just northeast of Raoul Island (Biggest and only populated island in the Kermandec group, about 1000km northeast of New Zealand) overnight 28 March UTC, before being classified as ex-tropical on 29 March UTC. Only minor damage was reported on Raoul Island, the worst being a roof lost from a shed.

Other weather systems+

Heavy rain - in 24 hour period, White Grass Airport, Vanuatu recorded 104mm on 9-10 April and Sola (Vanua Lava), Vanuatu, 150mm on 9-10 May and Sola (Vanua Lava); Lupepau'a (Vava'u, Tonga,, 220mm on 6 June (after 98mm in 6 hours on 5 June) and Nausori, Fiji 204mm on 25 June

Large waves - southern coasts of Tuvalu and Fiji, long period southerly swell 2-4 metres during 19-21 May, peaking on the morning of 21 May.

Strong winds - Rarotonga, Cook Islands, winds of 34 knots gusting 49 knots on 11 May.

Combination of heavy rain and strong winds associated with tropical depression 12F – Bauerfield 110mm in 24hrs from 2100 UTC on 7 March to 2100 UTC on 8 March, and 80km/h gusting 100 km/h at 0440 UTC on 8 March.

+ This list may be incomplete. The onus is on participating countries to advise RSMC Wellington of all severe weather events.

3.2 Solomon Islands:

On 25 June 2011 a strong Southeast Trade Winds and Large Waves Advisory was issued for Rennell & Bellona, Makira, Temotu, southern Guadalcanal and Russell Islands and waters. Later it was extended to the south Western Province, eastern and southern Malaita during the Period.

3.3 Vanuatu:

A tropical low formed northwest of Vanuatu and moved east southeast across central Vanuatu from 7-9 March 2011. Bauerfield station recorded 102 mm in 24 hours to 2100 UTC

on 8 March. Bauerfield recorded winds 80km/hr gusting to 100. A tropical cyclone warning was issued.

A trough of low pressure lay near Vanuatu from 10-14 April 2011. White Grass, Tanna Island recorded 104mm in the 24 hours to 2100 UTC on April 10 and 73mm, on 11 April. Heavy rainfall warnings were issued.

A trough of low pressure extended over Vanuatu from 17-19 May 2011. 24 hour rainfalls were recorded at Anelgauhat, Aneityum of 107mm at 2100 uTC on 19 May and Sola, of 102mm at 1200 UTC on 18 May. Heavy rainfall warnings were issued.

3.4 Fiji:

Tropical Cyclone "Bune" passed near Southern Lau on 24 March. 30kt winds were observed and tropical cyclone warnings issued.

A belt of very strong southwesterly winds around a deep depression located many thousands of kilometres away generated damaging heavy swells that affected Fiji on 20 May. Waves 3.5-4.5m were recorded and there was some flood damage along the south coast of Viti Levu. Warnings were issued up to 48 hours in advance.

A trough of low pressure lay over Fiji on 25 June. 24 hour rainfalls to 1800 UTC on 24 June of 203mm at Nausori, Viti Levu and 103mm at Levuka, Ovalau. Heavy rainfall warnings were issued 24hrs in advance.

3.5 Samoa

A short lived small scale system produced severe local convective weather to the east and south side of the main island of Upolu on 10 June. A strong downburst led to heavy rain inland with very gusty winds, and a waterspout was observed. No warning was issued and neither were any hints given in the model guidance.

3.6 Cook Islands:

Rarotonga recorded strong winds of 94km/h at 0800 UTC on 11May. Heavy swells of 2.5 m were recorded at 1500 UTC on 8 May, 3m on 1500 UTC on 7 June and 3m at 1300 UTC on the 27thJune. Damaging Swell Warnings were issued by RSMC Nadi in all cases.

3.6 Tuvalu:

Large southerly swells 2-4m were observed 19-21 May 2011.

3.7 Kiribati:

Strong winds were observed with 30-32 kt wind gusts (marginal for a strong wind warning!) at Tarawa on 16, 17 and 19 March 2011. No strong wind warnings were issued by Nadi. Also, observed were 15-17kts winds on 24 May and 18-19kts on 14 June 2011. Strong wind warnings were issued by Nadi (though late).

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3.8 Niue:

A strong wind warning for Niue waters was issued by RSMC Nadi at 2357 UTC on 8 May and cancelled at 2322 UTC on 11 May. RSMC Nadi issued a strong wind warning for Niue waters with moderate to heavy swell at 1505 UTC on 3 June 1505UTC and was cancelled at 2321 UTC on 8 June. A strong wind warning issued for Niue land area at 0434 UTC on 4 June was cancelled at 1217 UTC on 7June. Eastsoutheast winds of

23Gust31knots were observed at Hanan Airport at 0400 UTC on 3 June. Total rainfall at Hanan Airport from 2000 UTC on 2 June to 2000UTC on 4 June 2000UTC was 84.9mm. A Damaging Heavy Swell Warning for Niue issued by RSMC Nadi at 1617 UTC on17 June was cancelled at 1634 UTC on 19 June. From 1200 UTC on18 June to 1200 UTC on 19 June swell wave heights of 3.0 to 3.5 metres were observed at Tamakautoga.

3.9 Tonga

There were 4 heavy rainfall events:

1. 7 April Fua'amotu recorded 120.8 mm in 18 hours 061200-070600 UTC
2. 03 May Fua'amotu recorded 41.7 mm over 6 hours -021200-021800 UTC
3. 21 May Fua'amotu recorded 40 mm over 6 hours -201200-201800 UTC
4. 30 May Fua'amotu recorded 101.5mm over 6 hours-291800-300000 UTC

Heavy rainfall warnings were issued for case 1 and 4 above.

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4. Comments about the SPG and the NWP products.

RSMC Wellington:

The UKMO and ECMWF precipitation probability charts continue to give a weak signal at 100mm over 24 hours, but a good signal for 50mm. In light of the raised threshold criteria, Wellington forecasters continue to refer to both these products, together with pattern recognition, to help determine the heavy rainfall guidance of 100mm or more over 24 hours.

The change in wind threshold to 30kt for including strong wind guidance on the SPG charts now better matches the guidance produced by UKMO and ECMWF; hence the number of over-forecasted strong wind areas has reduced markedly. Forecasters rely on local observations to help determine the areal extent of 30kt winds. This helps to prevent over-forecasting in the short term.

Wave guidance continues to appear on the charts frequently. Forecasters find the wave data from ECMWF and other providers very helpful and reliable in determining waves ≥ 2.5m north of 15S and ≥ 3.5m at and south of 15S.

Fiji:

South Pacific Guidance charts were very useful, except for the heavy rainfall event on 17 June. Deterministic and ensemble forecasts from the UKMO and the ECMWF were also generally useful.

Samoa: In general, the SPG charts, and the UKMO and ECMWF models were very useful. However, no guidance gave advice in advance for the June severe convective storm.

Vanuatu:

Both the SPG and the TC Outlook products were very useful .They gave the Vanuatu forecasters confidence in the issuing of the warnings with good lead time. Vanuatu mentioned there is a downside to this: Forecasters, mostly inexperienced ones, tend to rely heavily on the guidance so could overlook important observations. to analyze local and initial conditions.

SIMS:

The SPG provided by RSMC Wellington for the June wind event was very useful. The deterministic and ensemble models from the UKMO were also very useful.

Niue:

Niue have found both the SPG and the model products very useful**.** Niue would like additional in country training to help interpret the Darwin precipitation products**.**

Tuvalu:

Tuvalu found both the SPG and the model products (and especially the UKMO's products) very useful

Kiribati:

Lack of understanding and poor connectively issues have meant KMS are not using MetConnect Pacific properly. SPG charts on MetConnect are not used. There is not much understanding by KMS officers. They usually just focus on the Kiribati weather forecast prepared by RSMC Nadi.

Tonga: The SPG was useful for events 2 and 4 above . Unfortunately for event 1 it was not. The UKMO and the ECMWF products were also useful and challenging when they forecasts differed for the same event.

5. Project evaluation against SWFDDP goals:

5.1 To improve the ability of NMHSs to forecast severe weather events

All NMHSs agreed that the SWFDDP products and, in particular, the SPG charts have increased the NMHSs' ability to issue warnings and strengthen the forecasters' confidence in doing so. SIMS commented that the SWFDDP is the first project to help improve SIMS severe weather forecasting and warning capabilities after 10 years of operation.

5.2 To improve the lead time of alerting these events

All NMHSs agreed that the SWFDDP products allowed them to improve the lead time. Fiji was able to send Damaging Swell Warnings up to 2 *days* in advance of wave events. Vanuatu was able to give warnings at least 6 hours in advance. SIMS issued swell warnings with more than 24 hours lead time. Fiji issued warnings for the Niue and Cook Islands swell events well in advance. For Tonga the SWFDDP products have given them confidence to try to meet their goals of 6-12 hours lead time for heavy rainfall and 12-24 hours for the wind warnings.

5.3 To improve the interaction of NMHSs with Disaster Management and Civil Protection Authorities (DMCPA) before, during and after severe weather events

Several (Fiji, Samoa, SIMS, Niue, Kiribati, Tonga) reported no interactions with their DMCPA's. The Cook Islands had some interactions. Vanuatu has improved interactions and cites as evidence that warnings include an advisory from the National Disaster Office. Tuvalu comments that the frequency of interactions with the DMCPA's has improved.

5.4 To identify gaps and areas for improvements

Fiji, Samoa, SIMS and Niue cited lack of experience and require in-county training. SIMS would like other additional training and also cites lack of financial support. Cook Islands would like to see onshore wave observations. When the confidence is low in a situation Tonga forecasters are be encouraged to discuss it with senior forecasters in Wellington and Nadi.

5.5 To improve the skill of products from Global Centres and RSMCs through feedback from NMHSs

Samoa's intense local convection event was not forecast by any model. Vanuatu would like to be more precise about which islands will be affected by heavy rainfall. Niue suggests that swell heights may have been over forecasted by RSMC Wellington.

RSMC Wellington finds that there is a weak signal for heavy rainfall over 100mm in the UKMO and ECMWF forecasted probability products. Forecasters must rely on pattern recognition.

Tonga cited discrepancies between Nadi and Wellington's MSL analyses; and found that forecast precipitation amounts are usually underestimated, timing is either too early or too late or with no rain at all. (NMHS's are encouraged to document the cases by citing examples or better yet make a case study).

6. Evaluation of the weather warnings:

6.1 Feedback from the public

For Fiji, Tuvalu, Kiribati and Samoa --there was no feedback. Vanuatu has received thanks for the timely warning. SIMS received thanks from several islands. In Niue, the fishermen thanked the service for the heavy swell warnings. In the Cook Islands, users asked when the heavy swell was to occur (*presumably that was not clear in the warning*).

6.2 Feedback from the DMCPA's

Warnings for Vanuatu and Cook Islands were well received by their DMCPA's. Tuvalu has tried to work closely with the DMCPA; their efforts were greatly appreciated.

In Samoa the DMCPA confirmed the severe local weather event.

Fiji, Niue, Kiribati Tonga and SIMS had no interaction with their DMCPAs.

6.3 Feedback from the Media

Fiji cites an article from a local paper exhorting the public to heed the warnings. In Vanuatu the graphical products and timely warnings were well received by the media. Tuvalu worked closely with the media and received a number of calls requiring updates.

Samoa, SIMS, Kiribati, Tonga and Niue received no feedback. In the Cook Islands warnings were quickly posted by the local media.

6.4 Objective verification by the NMHSs

The following is an objective verification by RSMC Wellington.

The table show the number of South Pacific Guidance Charts produced from 1 March 2011 to June 30 2011 under the various categories and different countries. Large waves predominated in this period.

Threshold Criteria: Rain ≥ 100mm per day and/or Winds ≥ 30 knots and/or Large waves ≥ 2.5m north of 15S and ≥ 3.5m at & south of 15S.

Mar/Apr/May/Jun	SWFDDP area	Solomon Islands	Vanuatu	Kiribati	Tuvalu	Fiji	Samoa	Tonga	Niue	Cook Islands
Heavy rain	446	89	131	0	0	47	15	52	7	24
Strong wind	216	5	41	0	0	19	2	16	3	51
Large waves	847	61	135	128	17	56	156	99	87	387
TC references	45	0	11	0	0	13	0	13	0	0
Combination of one or more of above	949	112	228	128	17	91	156	135	92	391
NIL SIG	266	1103	987	1087	1198	1124	1059	1080	1123	824
Total	1215	1215	1215	1215	1215	1215	1215	1215	1215	1215

The appendix below has an evaluation of the SPG' performance for TC Bune and 5 other events.

There are charts and tables covering the 4 days leading up to the naming of tropical cyclone Bune. It wasn't mentioned in RSMC Nadi's TC Outlook until the day before Bune was named. The SPG charts provided useful heavy rainfall guidance from 4 days out.Five non–tropical cyclone events have been catalogued in the appendix – 3 rain, 1 wind and 1 wave (affecting two countries). The SPG charts provided very useful information for two rainfall events and the wave event. The wind event over the Southern Cooks was out of sight until the day it happened (Force 6 winds were expected but not any stronger) and the Fiji heavy rain was picked in the further outlook but dropped off the charts closer to the event

7. Case studies:

RSMC Wellington circulated a proposed template for case studies (dated 12 May). No formal case study has been prepared (with this template). Cook Islands submitted a series of exchanges for the 6-8 May large wave event that could be reformatted as a case study. SIMS submitted a PowerPoint with much of the pertinent information including press clippings for the large wave event at the end of June 2011. Fiji is preparing a report on damaging swell event. RSMC Wellington has started a case study of a classical cool season event. In future, participating countries should post case studies for at least one significant event during the period (if there was one!) by using the template.

8. Conclusions:

A few NMHS's were very late in submitting their reports. In fact, the last reports for this period were received a month after the due date – 1200 UTC 16-July 2011. Only one NMHS didn't submit all reports - no Appendix Hs and their Appendix I was done incorrectly (completed for each month instead of once for the entire period).
With the exception of Vanuatu and Tuvalu who mentioned interactions with the DMCPA and cited some evidence of improvements no other showed improved interactions. Cook Islands mentioned some interactions and the others cited no interactions. Vanuatu and SIMS and the Cook Islands cited the feedback from media and the public on a job well done. In their PowerPoint of the swell event SIMS cited a newspaper report on the aftermath of the large wave event at the end of June. Fiji cited a newspaper article that asked their readers to heed the warnings. It is suggested that more of this feedback be solicited from the ***main target groups*** to demonstrate the real value of the SWFDDP to the South Pacific islands.

Many NMHS's mentioned forecaster inexperience as an issue or a requirement for in-country training. Kiribati mentioned that they do not use the MetConnect products – and also cited forecaster inexperience. **As mentioned in SWFDDP news above, the MetService has secured training funding for all SWFDDP participating countries to be completed before the start of 2012/2013 cyclone season**.

The two-tier criteria for large waves might have caused some confusion amongst users for a while. This occurred when southwest swells appeared on the South Pacific Guidance charts

north of 15^0S but not further south because swells here did not exceed the 3m criteria.

Since the start of the Full Demonstration phase, RSMC Wellington has been providing additional information on rain/wind/waves when a TC Outlook has been in force on day 1 and day 2 but no tropical cyclone has existed or been named. This is designed to help fill the shortfall in specifics about heavy rain/strong winds/large waves when a simple TC Outlook envelope replaced a combined set of rain, wind and wave envelopes.

RSMC Wellington provided additional information on rain/wind/waves for up the 4 days before Tropical Cyclone Bune was named.

In the period 1 March – 30 June 2011, large wave events dominated the SPG. These forecasts were in the large part well done and well received by the participating NMHS's and their clients.

Heavy rainfall had the second most common occurrence and was a bit more difficult to forecast. RSMC Wellington has found it challenging to provide heavy rainfall guidance at the new 100 mm threshold especially when the NWP guidance has often been inconclusive for this and higher amounts. Forecasters are forced to rely on pattern recognition.

The wind guidance from both the ECMWF and UKMO has proved very reliable most of the time, as has the wave guidance from ECMWF.

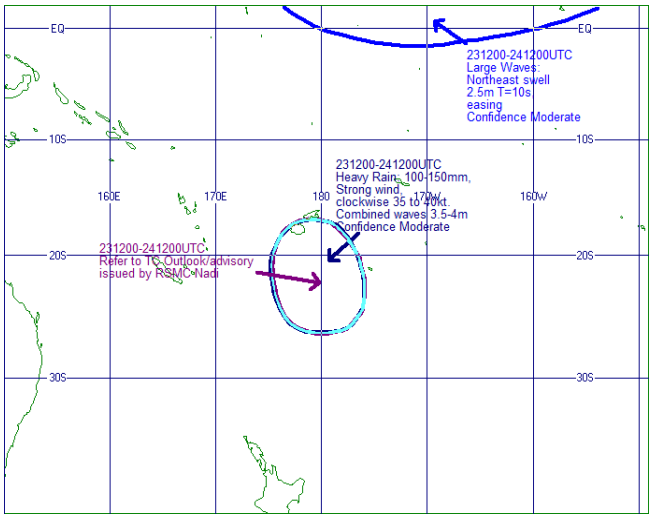
Localised heavy convection continues to bring its challenges as evidenced by the severe convective storm in Samoa that was not forecast by any model.

Appendix: Tropical cyclone events

Tropical cyclone events

Bune: (Named 0500 UTC on 24-March-2011)

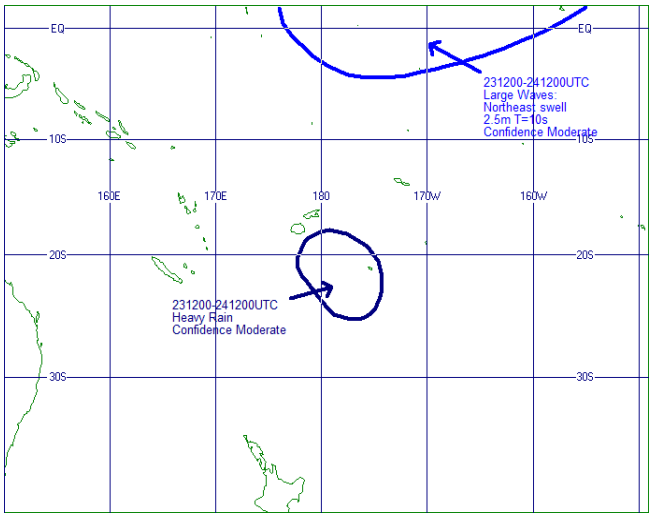
SPG chart issued 1 day before naming of Bune



Summary of details for Tonga and Fiji

TC Outlook	Yes		Tonga	Fiji
Rain	100-150mm	Mod	Tonga	Fiji
Wind	30-40kt	Mod	Tonga	Fiji
Waves	3.5-4m	Mod	Tonga	Fiji

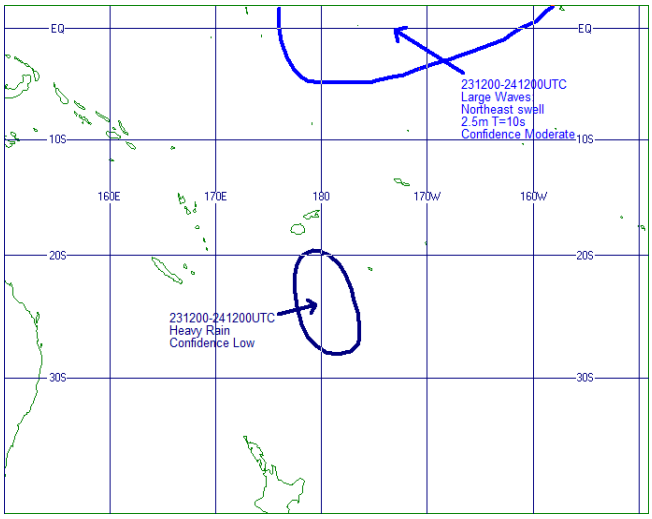
SPG chart issued 2 days before naming of Bune



Summary of details for Tonga and Fiji

TC Outlook	No			
Rain	Heavy	Mod	Tonga	SE Fiji
Wind				
Waves				

SPG chart issued 3 days before naming of Bune



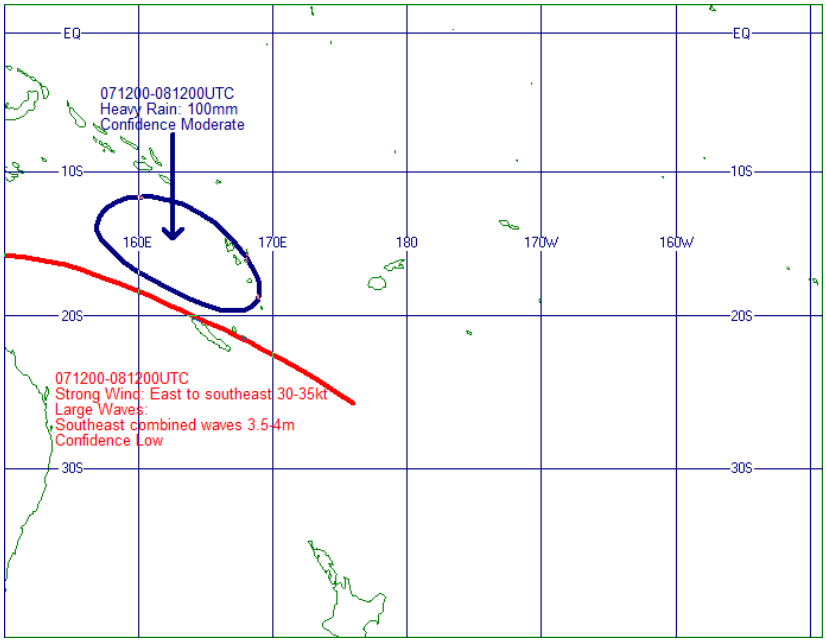
Non-tropical cyclone events (5 have been referenced below)

1. **8 March: Heavy rain and strong winds over southern Vanuatu – Bauerfield (110mm of rain in 24 hours and 80km/h gusting 100km/h at 0440 UTC on 8 March)**

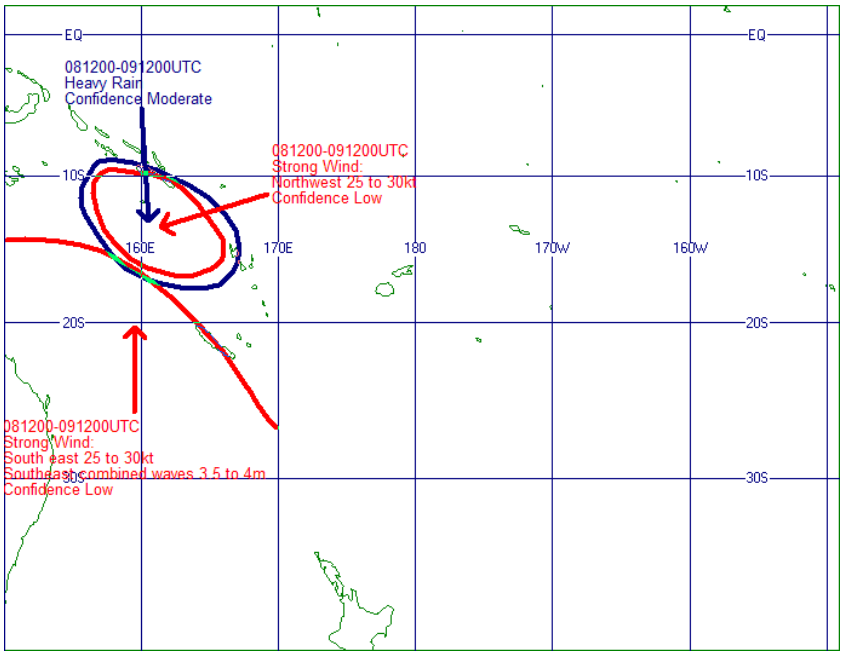
(EVENT FORECASTED 4 DAYS IN ADVANCE WITH ADEQUATE RAINFALL AMOUNTS)

SPG chart issued 2 days before heavy rain & strong wind event

Validity 1200 UTC on 7 March to 1200 UTC on 8 March

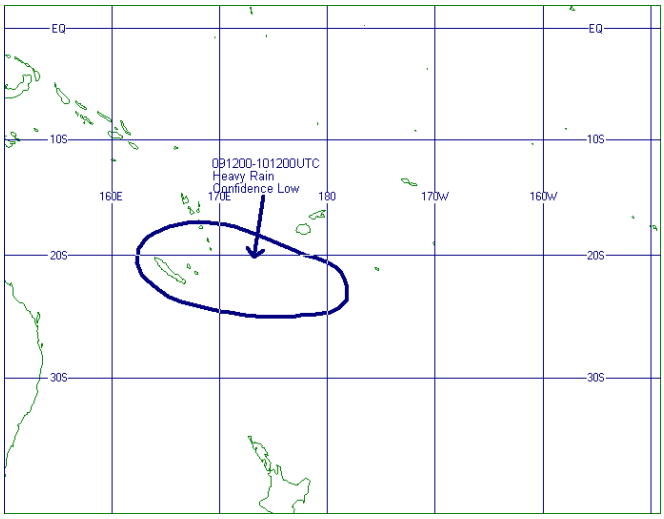


Validity 1200 UTC on 8 March to 1200 UTC on 9 March



2. **<u>10 APRIL</u>: Heavy rain over Vanuatu – White Grass (104mm in 24 hours)** (EVENT FORECASTED 4 DAYS IN ADVANCE WITH ADEQUATE RAINFALL AMOUNTS)

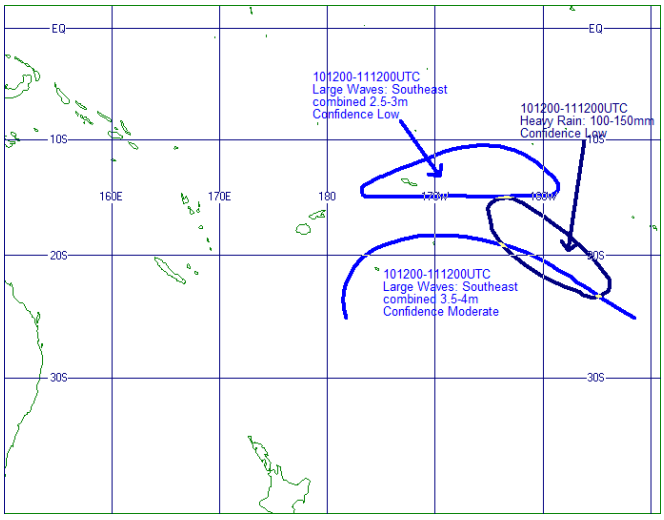
SPG chart issued 4 days before heavy rain event



3. **<u>11 MAY</u>: Strong winds over the Southern Cook Islands – Rarotonga (Max winds in knots 34 Gusting 49)**

(EVENT ONLY PICKED UP ONCE OBSERVATIONS CAME IN – NOT FORECAST IN ADVANCE)

SPG chart issued day before gale force winds

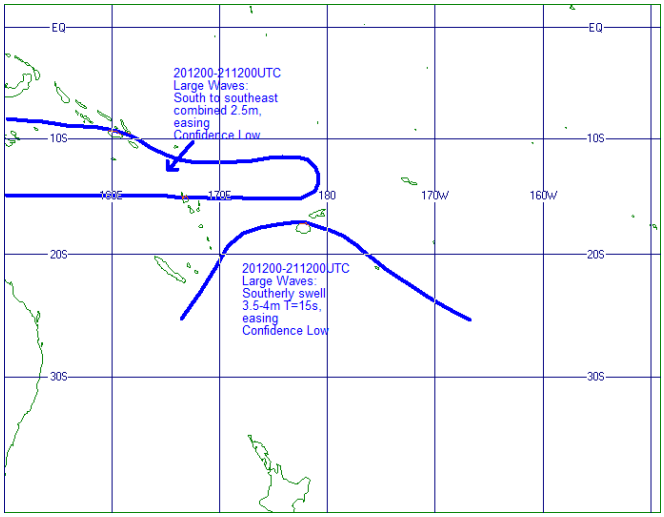


4. **<u>19-21 MAY</u>: Large waves for Tuvalu and Fiji – southern Tuvalu and southern Fiji (southerly swell 2-4m was the highest observed, on 21st but not necessarily the highest for the event)**

(EVENT FORECAST 4 DAYS IN ADVANCE FOR BOTH AREAS, HEIGHTS NOT QUITE HIGH ENOUGH FOR TUVALU)

See: http://www.stuff.co.nz/world/south-pacific/5033398/Waves-thrash-Fiji-coast

SPG chart issued 4 days out and later charts maintained this area of large swells near Viti Levu (Fiji)

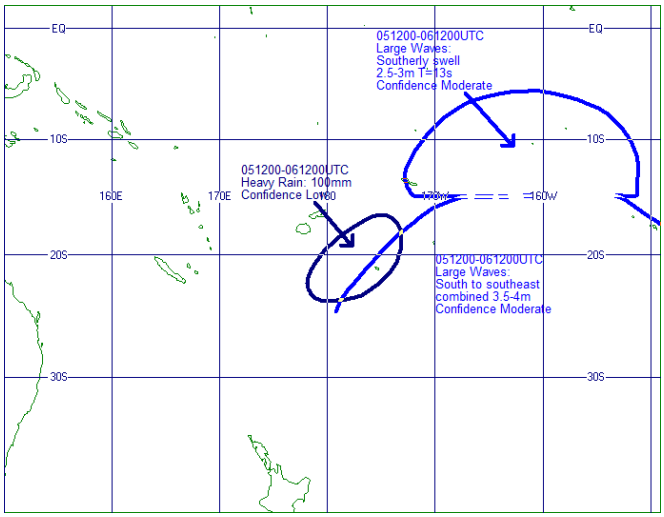


5. **<u>6 JUNE</u>: Heavy rain over Tonga – Lupepau'a (Vava'u group) 220mm in 24**

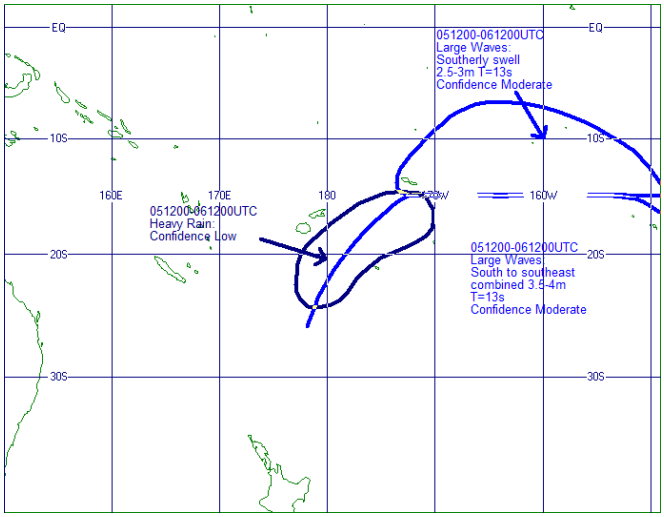
hours.

(EVENT FORECAST 3 DAYS IN ADVANCE, HOWEVER RAINFALL AMOUNTS NOT QUITE HIGH ENOUGH – 100-150mm)

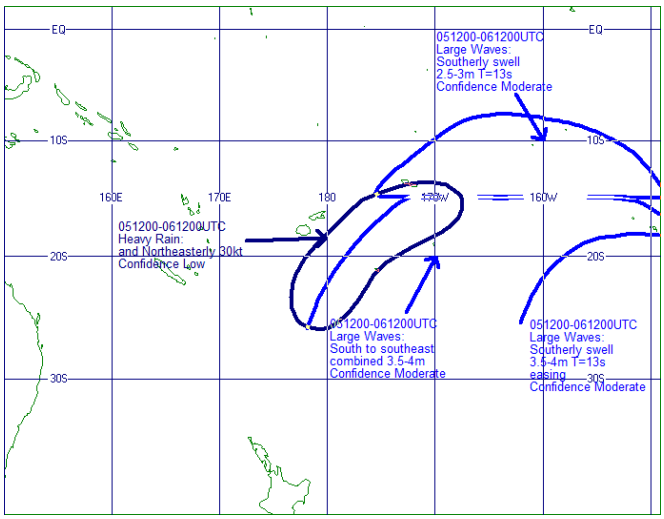
SPG chart issued day before heavy rain



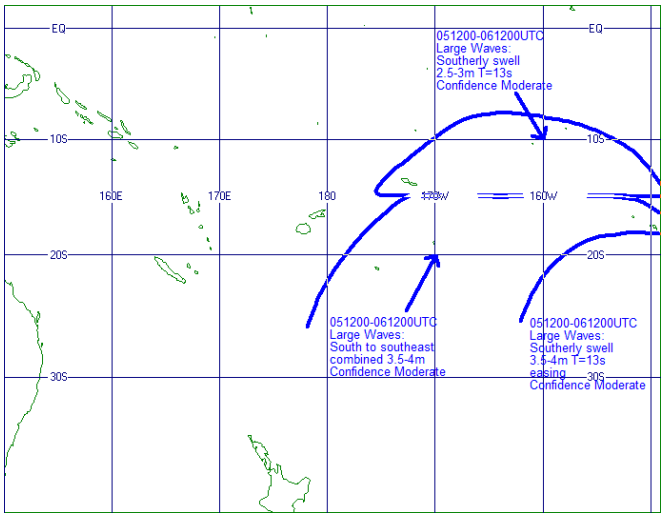
SPG chart issued 2 days before heavy rain



SPG chart issued 3 days before heavy rain

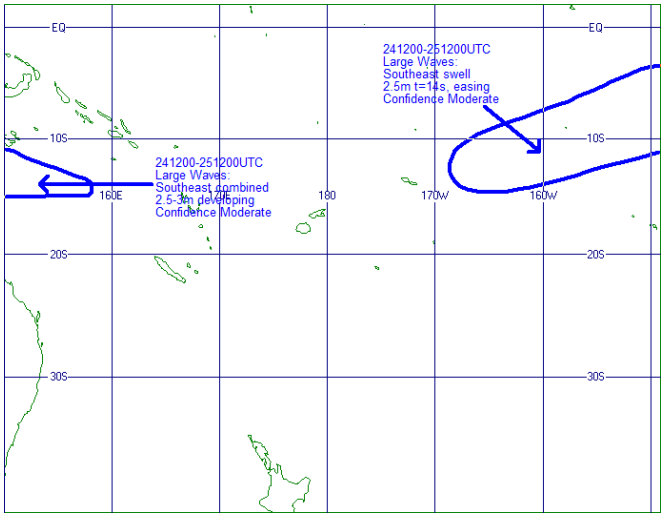

EQ
10S
20S
30S
160E
170E
180
170W
160W
051200-061200UTC
Large Waves:
Southerly swell
2.5-3m T=13s
Confidence Moderate
051200-061200UTC
Heavy Rain:
and Northeasterly 30kt
Confidence Low
051200-061200UTC
Large Waves:
South to southeast
combined 3.5-4m
Confidence Moderate
051200-061200UTC
Large Waves:
Southerly swell
3.5-4m T=13s
easing
Confidence Moderate

SPG chart issued 4 days before heavy rain

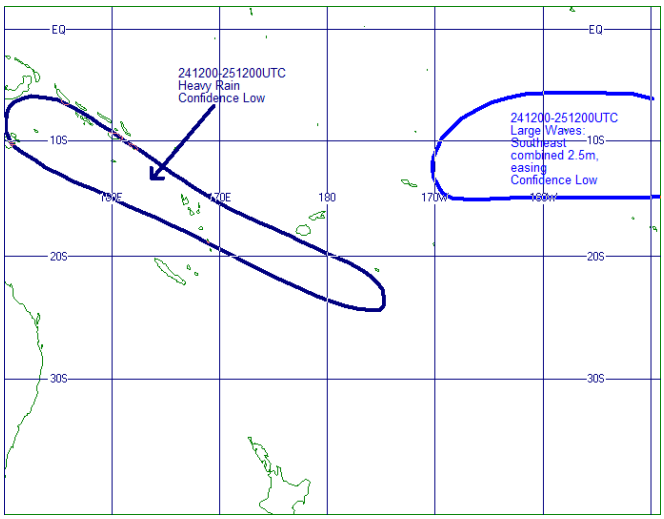


6. <u>25 JUNE</u>: Heavy rain over Fiji – Nausori 203mm in 24 hours.
(EVENT FORECAST IN THE FURTHER OUTLOOK, BUT MISSED CLOSER TO THE EVENT)

SPG chart issued day before and 2 days before heavy rain



SPG chart issued 3 days before heavy rain



SPG chart issued 4 days before heavy rain