

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

REGIONAL SUBPROJECT RA V

**PROGRESS REPORT N°5
For the period 1 March – 30 June 2012**

(15 August 2012)



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).

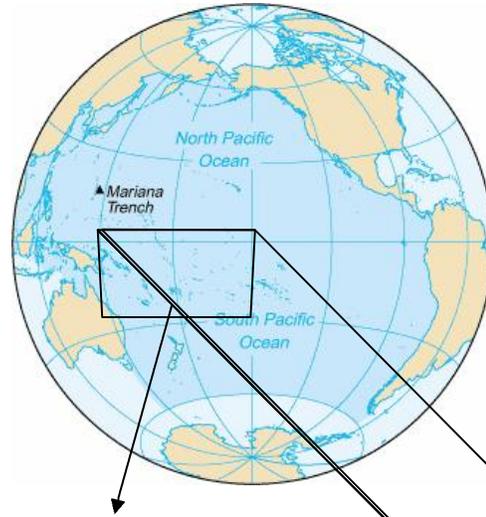
The principles and the goals of the Project were well outlined in section 1.1 of the plan. The Cascading Forecasting Process of global centres providing products through a lead RSMC to NMHSs is described in section 1.2. The overall framework of the Project in RA V is presented in section 1.3.

Full demonstration phase participants:

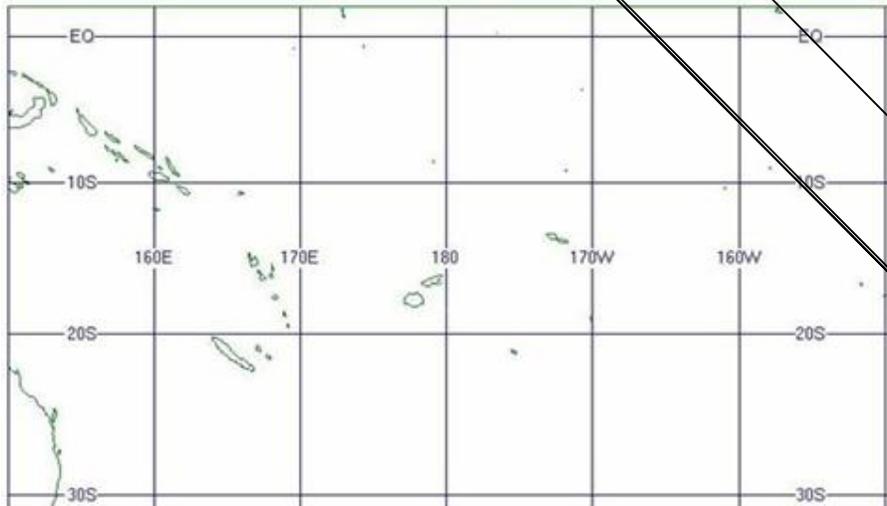
A Pilot phase involving a group of 4 participating countries in 2009/10 (Samoa, Vanuatu, Solomon Islands, and Fiji) was completed on 31 October 2010. It was followed by a full Demonstration phase in 2010/12 which includes the 4 Pilot phase NMHSs plus the following five NMHSs: Cook Islands, Niue, Kiribati,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

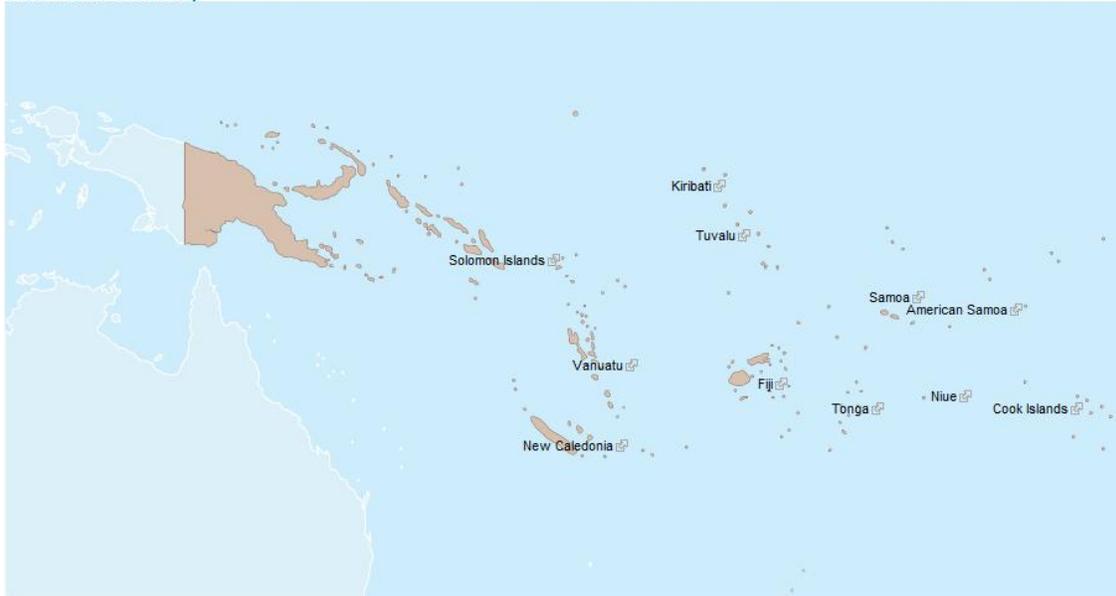


SWFDDP 'South Pacific Window' (subset of the above map)



South Pacific Ocean Map (showing location of participating NMHS)

South Pacific Ocean Map



This fifth Progress Report of the full Demonstration Project spans the period 1 March 2012 to 30 June 2012. The previous Progress Reports may be found at: <http://www.wmo.int/pages/prog/www/CBS-Reports/DPFS-index.html> .

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.

Of the participating countries, 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 any feedback should be passed on 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.

Reports¹ and feedback received from participating NMHSs for the period 1 March 2012 – 30 June 2012 (**Boldface**: Pilot phase participants)

Centre/Country	Event report (Appendix H)	Evaluation table(Appendix I)	Verification of warnings	Case studies ³
NMHS Samoa	x	x	²	
NMHS Solomon Is.	x	x	²	
NMHS Vanuatu	x	x	²	
NMHS Fiji	x	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	

¹ RSMC Wellington submitted a report describing its activities, major events and South Pacific Guidance evaluation statistics over the period. Both RSMC Darwin and RSMC Nadi submitted report outlining their activities.

² No NMHS has presented formal verifications of their warnings⁺ yet.

³ No NMHS has presented a case study for the period.

+ To put things in perspective, most NMHSs don't have a formal warning system in place at the moment, or are just trialling a system.

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 \geq 100mm/24hrs, winds \geq 30 knots and waves \geq 2.5m along and north of 15°S, and \geq 3.5m south of 15°S.

From 1 March to 30 June 2012, a total of 1220 South Pacific Guidance charts were produced by RSMC Wellington Lead meteorologists and posted on MetConnect Pacific. 77% of these charts contained guidance of one kind or another or a combination of one or more types of guidance. 28% of all charts contained guidance for the Cook Islands (mostly large waves with the criteria split between the Northern and Southern Cook islands); 26%, for Vanuatu and Fiji and 22%, for Samoa. Note that the dashed line along 15°South on the South Pacific Guidance charts marks the boundary for the change in the wave criteria.

Heavy rain/Strong Wind/Large Wave guidance was often combined for disturbances that showed potential for growing into a tropical cyclone. Heavy Rain guidance was prominent for the Solomon Islands and Fiji signifying the location and persistent nature of the South Pacific Convergence Zone (SPCZ) over this period. Large Wave guidance was prominent for Vanuatu, Fiji, Samoa and Cook Islands helped by long period southwesterly swells from high latitudes.

MetConnect Pacific: MetConnect Pacific website was down between 0300 and 0630 UTC on 30 June 2012 due to Amazon Cloud server issues otherwise the website continued uninterrupted. The South Pacific Guidance charts continued to be published on MetConnect Pacific twice a day around 0300 UTC (outage caused a delay on the 30-June) and 1500 UTC.

The RSMC Darwin images on MetConnect Pacific updated twice a day without any hitches. Under 'Wind Diagnostics', there are still a number of fields unavailable.

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 from 1 March to 30 June 2012. Charts and NWP products are available on the RSMC Darwin web site, and a selection of regional NWP products is available directly on the MetConnect Pacific web page.

ACCESS-TC, the moveable-domain high-resolution tropical cyclone model was implemented in November 2011. Track bulletins are now being sent to RSMC Nadi for use in TC track forecasts. ACCESS-TC charts and forecast tracks are available on the RSMC Darwin web page. Work is in hand to allow access to ACCESS-TC track maps and bulletins via the Met Connect Pacific web site.

New rainfall guidance maps are being developed for the SWFDDP based on a 'poor man's ensemble' (PME) of available global and regional NWP models. The performance of PME forecasts of rainfall accumulation and probability of exceeding rainfall thresholds over a south Pacific domain are currently being assessed prior to being made available to SWFDDP participants.

Upgrading of ACCESS NWP model suite APS1 (Australian Parallel Suite 1) from APS0 commenced early in 2012. The previous ACCESS-G model (80 km horizontal resolution) was replaced by a higher resolution (40 km) model with improved physics and an increase in vertical levels from 50 to 70.

Products that are produced for the SWFDDP from the current tropical model ACCESS-T (40 km resolution) will be generated from ACCESS-G before the operational ACCESS-T is switched off late in 2012. The tropical cyclone model ACCESS-TC will be migrated to ACCESS-G (from current ACCESS-T). Gridded data and products from ACCESS-TC will be available to SWFDDP participating countries. A new 12 km resolution regional model, ACCESS-R12 is expected to become operational in early 2013 over an

Australian domain. The next upgrade of ACCESS-G with horizontal resolution of 25 km is expected to take place during 2013.

2.3 RSMC Nadi

Tropical Daphne was named at 0200 UTC on 2 April when it was to the southwest of Fiji. It developed and remained over open waters for its entire lifespan with no effects on the surrounding islands, thus no Special Weather Bulletins were issued. In total, 6 Tropical Cyclone Advisories and 6 International Marine warnings were issued for Daphne.

TC Outlooks were issued at 0400 UTC daily during the cyclone season, containing details about the current situation and the potential for fresh tropical cyclone formation in the region over the following 3 days. Input for the 3 Day TC Outlook comes from the SWFDDP website in the first instance then it is consolidated by checking with other global models. Although the 3 Day TC Outlook hasn't been rigorously verified, the perception is it does a good job and it can be relied upon for reference and guidance.

During the review period, Damaging Swell Warnings were issued for some of the Pacific Island countries. During the months of April, it was issued for Fiji due to the passage of TD19F. Late May and early June, Damaging Swell Warnings were issued for Niue and Southern Cook Islands due to long period southerly swells originating from high latitudes. The Southern Pacific Guidance charts were used as a first reference for forecasting damaging heavy swells around the affected islands.

2.4 Products from global centres:

ECMWF: The ECMWF products continued without interruption during the reporting period and were well received by SWFDDP forecasters.

UK Met Office (UKMO): UKMO products continued without interruption during the reporting period and were well received by SWFDDP forecasters.

JMA: JMA provides products from its global ensemble system (GMS) and these are appreciated by SWFDDP forecasters. They include 500 hPa spaghetti plots and probabilities of precipitation or wind for different thresholds. EPSgrams for several locations in the South Pacific are also available. Because of the coarse resolution of the EPS system, some EPSgram stations on the South Pacific islands are represented by grid points over the sea. The satellite nowcasting product is able to identify areas of heavy precipitation over the South Pacific. See: http://www.wis-jma.go.jp/swfdp/ra5_swfdp_spi.htm

Other centres:

Following the training in Samoa, the US NOAA NWS is now providing a link to experimental NWP fields extracted from a WRF nested in the GFS model over a Fiji domain at 12km resolution and Samoa-American Samoa-Niue domain at 4km.

3. Summary of the severe weather events 1 March to 30 June 2012

3.1 Severe Weather Events reported by RSMC Wellington⁺: Weather Systems: Tropical cyclones

Daphne was named at 0100 UTC on 2 April while located east of southern Vanuatu and continued as a tropical cyclone until it was reclassified at 1200 UTC on 3 April near 30° well to the south of Tonga in the Wellington area of responsibility.

Weather Systems: other weather systems

The Table below has listed the number of heavy rain, strong wind, large wave and tropical cyclone events for each month for each participating country (Updated for reports received from Tuvalu, Niue and Samoa). There was one standout event – the severe flooding in parts of Fiji in late March/early April and 2 other events in Samoa lasting 2-3 days. For more details, refer to the various Country reports.

	Country	Date (UTC)	Month	Heavy Rain	Large Waves	Strong Wind	TC	SPG 1 day out	SPG 2 days out	SPG 3 days out	SPG 4 days out	Comment
1	Solomon Islands	13	May	123mm/24hr Santa Cruz				√				SPG displaced to west on other days
		23 to 2	May/June		No obs			√	√	√	√	MV Solfish sank south of Guadalcanal. All 49 on board rescued.
2	Vanuatu	30 to 2	Mar/Apr	122mm/24hr Sola Vanua		Below gale		√	√	√	√	Precursor to TC Daphne
		16 to 17	May	189mm/24hr Pekoia				√	√			SPG displaced to west on other days
		10 to 14	June			No gales obs		√	√	√	√	
3	Kiribari											No events
4	Tuvalu	18 to 21	March	106mm/24hrs Funafuti								Nothing on SPG charts in the vicinity
		24	March	181mm/24hrs Niulakita								Nothing on SPG charts in the vicinity
		26	March	116mm/24hrs Niulakita				√	√	√	√	Northern edge of SPG near Niulakita
		26 to 27	May	129mm/24hr Funafuti								SPG didn't cover the area.
5	Fiji	28 to 3	Mar-Apr	nearly 700mm/72hrs Nadi Airport				√	√	√		300mm/12hrs. TD17F affected Fiji.
		19 to 20	April	152mm/24hr eastern Vanua Levu				√	√	√		

		12 to 24	June	165mm/24hrs Ovalau, Nadi Airport								SPG didn't cover the area.	
6	Samoa	2 to 3	Mar	113mm/24hr Afiamalu (Upolu)								Nothing on SPG charts in the vicinity	
		20 to 21	Mar	101mm/5-6hrs					√	√	√		
		23 to 26	Mar	383mm/72hrs Alaoa (central highland Upolu)					√	√	√	√	
		21 to 22	April	115mm/24hrs Sili (northeast Savai'i)								Nothing on SPG charts in the vicinity	
		23 to 25	May	200-500mm/24hr Upolu					√	√	√	√	
												Low over Samoa.	
7	Tonga	18	May	119mm/24hr Niua fo'ou								Nothing on SPG charts in the vicinity	
		13-15	June	122mm/24hr over Tongatapu					√	√	√		
8	Niue	28	May		Tamakautoga & Tapa Avatele 3-4m				√	√	√	√	Observations are probably estimates
		4	June		Tamakautoga & Tapa Avatele 3.5-4m				√	√	√	√	Observations are probably estimates
9	Cook Islands											No events	

The criteria used by participating countries don't necessarily match those used in the production of the South Pacific Guidance (SPG) charts.

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

3.2 Vanuatu:

A tropical depression travelled through northern and central Vanuatu from 1 to 2 April 2012, then became tropical cyclone Daphne between Vanuatu and Fiji.

In June, an active area of low pressure moved from the Coral Sea past the south of both New Caledonia and Vanuatu. It created strong west to southwesterly winds and very rough seas over Vanuatu Coastal Waters from 11 to 14 June 2012. A small boat with 8 people on board capsized, with all 8 lost and presumed dead. Apparently, the people on board were aware of the forecast and warning before undertaking the journey i.e. winds of 20 to 30 knots and wave heights of 3.5 to 4.0 metres.

March:

Rainfall of 121.7mm was recorded at Sola-Vanua Lava from 2100 UTC on 30 March to 2100 UTC on 31 March. Around the same time, there were reports of damages to houses, schools and garden crops mostly over southern islands (Tanna and Aneityum). There were also reports of inundation on the island of Aneityum. A heavy rainfall warning was issued at 0000 UTC on 29 March 0000UTC for the period 0000 UTC on 30 March to 1200 UTC on 31 March.

A tropical cyclone warning was issued several hours in advance for 1 April 2012. Rainfall of 91.4mm was recorded at Peko-Espiritu Santo for the period from 2100 UTC on 1 April to 2100 UTC on 2 April. Winds gusted to 30kts at Bauerfield-Efate at 1700 UTC on 1 April. There were damages to houses and garden crops on the Islands of Ambrym and Pentecost.

May:

Rainfall of 189.3mm was recorded at Peko-Espiritu Santo from 2100 UTC on 17 May to 2100 UTC on 18 May. No damage was recorded. A severe weather warning was issued well in advance.

June:

Strong winds over the Vanuatu marine areas were forecast from 10 to 13 June 2012 well in advance of the event. 8 lives were lost at sea and presumed dead.

3.3 Solomon Islands

Moderate to heavy swells (2.5-3.5m) were observed over the Eastern Regions Waters (Makira, Rennell & Bellona and Temotu waters) from 23 May to 3 June 2012. The MV SOLFISH sank between Makira and Temotu Islands waters between 1100 and 1600 UTC on 23 May. A large wave warning was issued on 22 May.

3.4 Fiji:

28 March to 3 April: 362.6mm was recorded at Lautoka Mill in the 24 hours from 2100UTC on 28 March. 150 to 200mm was recorded each day. Winds gusts of 76km/hr were recorded at Nadi airport at 0600 UTC on 30 March. The heavy rain and winds were associated with tropical depression 17F. Floods covered most of the Western Division claiming 5 lives. The Government of Fiji declared a state of Natural Disaster for parts of Western Division. Around 8.584 people stayed in evacuation centres in the Western Division, of which 41 are schools. Roads and bridges were washed away and flights were cancelled for some time. Water and power supply systems were seriously damaged. Estimates of damages largely to infrastructure and agricultural crops estimated to be more than F\$50 million dollars. A heavy rainfall warning and wind warning were issued 24 hours

before the start of the event. The coordination between FMS and the National Disaster Management Office (NDMO) was good. The Commissioner of the Western Division visited FMS on many occasions and was briefed on the weather situation and its development over the next few days. The Honourable Prime Minister and his delegation also visited the office on 05 April and were subsequently briefed by the Director of Meteorology. Representatives of FMS also presented at the NDMO Operation Centre in Lautoka on 6 and 7 April as part of the Prime Minister's daily briefing. The warnings were also pasted on the FMS's Facebook page for easy access by the general public. Fiji should be commended on this good coordination between FMS and NDMO. This is also a very good public relations exercise. This example should be highlighted as a good practice to be shared with the other islands.

19 April 2012: A trough triggered connective activity over much of Yasawa, Vanua Levu, Taveunu, northern Lau and the Lomaiviti group. Udu Point recorded 152.2mm from 2100 UTC on 19 April to 2100 UTC on 20 April. Heavy rainfall warnings were issued 24 hours in advance of onset.

9 May 2012: 110mm was recorded at Tokotoko, Navua in the 24 hour period from 2100 UTC on 9 May. Some roads were flooded. No warnings were issued.

15 May 2012: 120.7mm fell at Udu Point and 81.9mm at Yasawa in the 24 hours from 2100 UTC on 15 May. No warnings were issued.

12 June 2012: 165.3mm was recorded at Nadi Airport and 112mm at Lautoka Mill from 2100 UTC on 12 June to 2100 UTC on 13 June. The heavy rain closed one school in the Western Division. A heavy rainfall warning was issued at the start of the event without any lead.

3.5 Samoa

Weather from the 1 March to 30 June was dominated by trade wind weather which generally implies fine weather. There were a few exceptions of easterly shortwave troughs, wind speed convergences and frontal systems that brought some showers over the group. Some of these systems were enhanced by upper level trough from the west and provided some brief moderate falls.

2 to 3 March 2012: 113mm was recorded at Afiamalu from 2000 UTC on 2 March to 2000 UTC on 3 March. No warnings were issued.

20 to 21 March 2012: 100.5mm was recorded at Mt Fiamoe (central highlands) from 2000 UTC on 20 March to 2000 UTC on 21 March. No warnings were issued.

23 to 24 March 2012: 116.8mm was recorded at Asau (west Savai'i) from 2000 UTC on 23 March to 2000 UTC on 24 March. No warnings were issued.

21 to 22 April 2012: 114.6mm was recorded at Sili (northeast Savai'i) from 2000 UTC on 21 April to 2000 UTC on 22 April. No warnings were issued.

23 to 25 May 2012: 151.8mm was recorded at Salani (southeast) from 2000 UTC on 22 May to 2000 UTC on 23 May; 159mm and 179.4mm fell on subsequent days, giving

490.2mm over 72 hours. At Nuusuatia (southwest), 216.2mm fell in 24 hours to 2000 UTC on 23 May and 207.8mm, in 24 hours to 2000 UTC on 25 May. A Flood Advisory was issued at 0100 UTC on 24 May more than 24 hours after the heavy rainfall event had started.

3.6 Cook Islands:

There were no reports of severe weather events during this period.

3.7 Tuvalu:

There were 5 heavy rainfall events:

18 March 2012. Total rainfall of 105.8mm at Funafuti was recorded from 2100 UTC on 17 March to 0900 UTC on 18 March. No warnings were issued.

21 March 2012. Total rainfall of 94.4mm at Funafuti was recorded from 2100 UTC on 20 March to 0900 UTC on 21 March. No warnings were issued.

22 to 27 March 2012. Total rainfall of 180.9 mm at Niulakita was recorded on 24 March, and 115.7mm on 26 March. No warnings were issued.

26 May 2012. Total rainfall of 128.6mm at Funafuti was recorded from 2100 UTC on 25 May to 0900 UTC 26 May. No warnings were issued.

3.8 Kiribati:

There were no reports of severe weather events during this period.

3.9 Niue:

May: A trough of low pressure to the west of Niue brought heavy rain and thunderstorms on 3 and 4 May UTC resulting in 86.7 mm in 24 hours.

A low pressure system to the southeast of Niue generated heavy southerly and southeast swells over Niue coastal waters from 27 May 2012. At Tamakautoga and Tapa, Avatele 3 to 4m waves were observed around 0300 UTC on 28 May. A Damaging Swell Warning was issued at 2339 UTC on 27 May and cancelled at 2330 UTC on 28 May.

June: 3.5 to 4.0m waves were observed around 0500 UTC on 04 June at Tapa, Avatele and Tamakautoga. A Damaging Swell Warning was issued for Niue at 1555 UTC on 3 June and cancelled at 2249 UTC on 4 June.

3.10 Tonga

April: A heavy rain and strong wind advisory was issued for the period from 1500 UTC on 1 April to 1200 UTC on 2 April. Fua'amotu recorded 55km/h winds on 2 April as well as rainfall of 51.0mm in 6 hours from 0000 UTC on 2 April.

A Heavy Rainfall warning was issued for the period from 1800 UTC on 4 April to 1200 UTC on 5 April. On 5 April, Fua'amotu recorded 41.5mm in 6 hours from 0000 UTC.

June: A heavy rainfall warning was issued for the period from 1800 UTC on 12 June to 0000 UTC on 15 June.

Fua'amotu recorded 122mm from 2100 UTC on 12 June to 2100 UTC on 13 June.

Nuku'alofa recorded 107mm from 2100 UTC on 12 June to 2100UTC on 13 June.

4. Comments about the SPG and the NWP products.

RSMC Wellington

US Satellite hydro-estimation data are proving useful in estimating how much rainfall has occurred up to the start of the forecast period or an indication of how much might have fallen during an event just completed.

The following statements have appeared in previous reports but still hold true now:

- The UKMO and ECMWF precipitation probability charts continue to give a weak signal at 100mm over 24 hours and a good signal for 50mm. Wellington forecasters rely on both these products, together with the help of pattern recognition, to estimate rainfall totals ≥ 100 mm in 24 hours.
- The change in the wind criteria now better matches the guidance produced by UKMO and ECMWF; hence the number of over-forecast strong wind areas remains small. Forecasters continue to rely on local observations to help determine the areal extent of 30kt winds on days one and two.
- Wave guidance continues to appear on the charts in high frequency, but the change in criteria has made a significant difference to the amount of wave guidance south of 15°S. Forecasters continue to access ECMWF wave data specifying each half metre, allowing easier determination of waves ≥ 2.5 m, north of 15°S and ≥ 3.5 m, south of 15°S. The model guidance has proved to be very reliable with forecasters picking large wave events from 4 days out.

Fiji

South Pacific Guidance charts were useful for all the March and April events but they did not pick up the May event and were late for the June event. Ensemble forecasts from the UKMO, GFS and the ECMWF were also generally useful especially the meteograms from the ECMWF. ACCESS-G model was also used.

Samoa

SPG charts were always useful; not only in diagnosing the weather systems that produced the significant events but also in guiding forecasters in making quick forecast decisions. Occasionally, the guidance was misleading indicating potential events away from where they actually occurred. The products from the NWP centres (ECMWF, UK, GFS and JMA) were always useful in determining the intensity and duration of each event.

Vanuatu

The SPG products were very useful. They gave the Vanuatu forecasters confidence in issuing the warnings with good lead time. The NWP/Ensemble products (ECMWF, UKMMO, GFS, ACCESS-T) were very useful.

SIMS

The SPG charts provided by RSMC Wellington were very useful. NWP/Ensemble products received from ECMWF and ACCESS-T were very useful.

Niue

Niue has found both the SPG and the model products (ACCESS-T, UKMO and ECMWF) as very useful as a form of extended outlook but still relies on Nadi for actual forecasts and warnings from day to day.

Tuvalu

Tuvalu found both the SPG and the model products very useful. The SPG gives a quick heads up on upcoming severe weather. Strong wind warnings are issued based on the UKMO and ARL EPS Meteogram. UKMO EPS Meteogram, wind and precipitation probability charts are frequently used for rainfall and wind speed information in the 3 day outlooks and in special requests.

Kiribati

The SPG is useful and gives the forecaster a good heads-up on upcoming severe weather. Ensemble products from the UKMO and the ECMWF are also useful as are the RSMC Darwin products. Kiribati relies on Nadi for its forecasts.

Cook Islands

The Cook Islands finds both the SPG charts and the NWP guidance useful, in particular, the RSMC Darwin products in adding value to the forecasts issued by Nadi.

Tonga

Tonga finds the SPG charts very useful. The model output is generally helpful but can be difficult to reconcile when there is conflict among the models.

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 helped to give NMHSs more confidence about an expected significant weather or wave event.

5.2 To improve the lead time of alerting these events

All NMHSs (who issue warnings) agreed that the SWFDDP products helped them to maintain a healthy lead time or enabled them to issue warnings where they had not before. Fiji was able to issue warnings at least 24 hours before events. The Solomon Islands issued warnings 12 hours in advance for the May events and even earlier for other events. Vanuatu was able to issue warnings 6 to 12 hours before non-Tropical Cyclone events and more than 24 hours for TC events.

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

Several (Samoa, SIMS, Kiribati (no severe weather), Niue, Tonga and Tuvalu) reported no interactions with their DMCPAs. Fiji had several interactions (see country report above) with the DMCPA during a number of events. In Vanuatu, the NMHS works closely with their DMCPA.

5.4 To identify gaps and areas for improvements

Fiji would like to improve their forecasting of heavy rain and flood warnings Vanuatu was unable to verify its wave forecasts. SIMS cited lack of experience of some forecasters. Tonga found that the SPG tended to over forecast some precipitation events. Kiribati has a slow internet connection and experiences trouble accessing the MetConnect Pacific site.

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

Fiji stated that the March rainfall event was under forecast by the SPG though the timing was good. Niue cited that the UKMO and the ECMWF models tend to over forecast precipitation events. The Cook Islands and SIMS could not find any weaknesses.

6. Evaluation of the weather warnings:

6.1 Feedback from the public

In Fiji, the responsibility for issuing flood warnings lies with the Hydrology division of Water Authority of Fiji. For the March event, the flood warnings were issued late which resulted in criticism from the public. After that event the responsibility was transferred to the Fiji Meteorological Service (FMS). Vanuatu received positive feedback for its timely warnings.

Otherwise, there was nothing else of note to report.

6.2 Feedback from the DMCPA's

The Vanuatu National Disaster Management Office acknowledges the importance of the warnings. An MOU is in draft and will be finalized shortly to strengthen this relationship. Fiji worked closely with their disaster management office.

Otherwise, there was nothing else of note to report.

6.3 Feedback from the Media

Fiji and Samoa cited that the media promptly relayed the weather forecast updates. Cook Islands sent probability information to media for inclusion in the forecast or in an article. Vanuatu had feedback through social media on the importance of their warnings.

Otherwise, there was nothing else of note to report.

6.4 Objective verification by the NMHSs

There was no objective verification by the NMHSs (Refer to comment underneath table in section 1)

The following is from RMSC Wellington's report:

The table below shows the number of South Pacific Guidance Charts produced from 1 March to 30 June 2012 under the various categories and different countries. A total of 1220 South Pacific Guidance charts were produced by RSMC Wellington Lead meteorologists and posted on MetConnect Pacific and 77% of these charts contained guidance of one kind or another or a combination of one or more types of guidance. 28% of all charts contained guidance for the Cook Islands (mostly large waves with the criteria split between the Northern and Southern Cook islands); 26%, for Vanuatu and Fiji and 22%, for Samoa.

Heavy rain/Strong Wind/Larges Wave guidance was often combined for disturbances that showed potential for growing into a tropical cyclone. Heavy Rain guidance was prominent for the Solomon Islands and Fiji signifying the location and persistent nature of the South Pacific Convergence Zone (SPCZ) over this period. Large Wave guidance was prominent for Vanuatu, Fiji, Samoa and Cook Islands helped by long period southwesterly swells from high latitudes.

1 Mar to 30 June 2012	SWFDDP area	Solomon Islands	Vanuatu	Kiribati	Tuvalu	Fiji	Samoa	Tonga	Niue	Cook Islands
Heavy rain	591	185	108	1	28	178	37	87	16	95
Strong wind	250	45	47	0	0	65	9	24	16	68
Large waves	743	107	291	8	101	220	237	116	44	286
TC references	28	9	16	0	0	14	0	0	0	0
Combination of one or more of above	938	234	321	9	126	314	267	182	58	344
NIL SIG	282	986	899	1211	1094	906	953	1038	1162	876
Total	1220	1220	1220	1220	1220	1220	1220	1220	1220	1220

Individual NMHS should keep their own tally of Hit/Miss of the warnings and of the SPG charts. At the same time, they could match up forecasts and warnings issued and keep a score of how useful the South Pacific Guidance charts were leading up to a warning, and for any warnings they issue, the probability of success and false alarm ratio for each event. This will lead to a rudimentary verification by NMHS's.

7. Case studies:

Fiji produced a case study on the March-April floods which was presented at the RA V Tropical Cyclone Committee meeting in Samoa from 16 to 20 July 2012.

8. Conclusions:

Most NMHS's submitted reports at or near the deadline. A few were late by a few days and Vanuatu was more than 10 days late. The reports followed the format prescribed.

The March flooding event was an important one for Fiji – there was high visibility for the FMS. As a post mortem to the event the responsibility for the issuance of flood forecasts was shifted to the FMS.

In this progress report there are still a number of NMHS's that have no interaction with the DMCPA's, media or the public.

Kiribati mentioned that they still have bandwidth problems that lead to connection difficulties with MetConnect Pacific.

It was an active period for severe weather with NMHS's reporting multiple severe weather events. Many of the NMHSs succeeded in issuing warnings well in advance of the events.

Steve Ready attended the 10th International Conference on Southern Hemisphere Meteorology and Oceanography (ICSHMO-X) in Noumea, New Caledonia. His presentation covered aspects of severe weather forecasting in the South Pacific including SWFDDP.

The New Zealand MetService commenced a second round of SWFDDP in-country training visits to participating countries (Solomon Islands, Vanuatu, Kiribati, Tuvalu, Fiji, Samoa, Tonga, Niue and Cook Islands) in May 2012. James Lunny and Jonathan Tunster have conducted 3-5 days' training in Samoa, 7-11 May; Fiji and Kiribati, 12-22 June covering all aspects of the 'Cascading Process' including a half to full day workshop involving several agencies connected to emergency response. The MetService would like to acknowledge the role of the New Zealand Ministry for the Environment (MfE) and the New Zealand Ministry of Foreign Affairs and Trade (MFAT) in funding the entire SWFDDP in-country training programme which won't be completed until November 2012. The MetService would also like to acknowledge the support provided by USA NOAA NWS staff in helping with and contributing to components of the training in Samoa and Fiji. The New Zealand High Commission in Apia, Samoa, assisted in having an article of the in-country training published in two of the Samoan newspapers. The next training trips include the Cook Islands, 17-21 September 2012; Tuvalu and Tonga, 2-12 October 2012; Solomon Islands and Vanuatu, 22 October to 2 November 2012 and Niue, 19-23 November 2012.

Whenever a Tropical Cyclone Outlook was in force on day 1 and day 2 and no tropical cyclone named, Wellington forecasters included extra rain/wind/wave information as part of the 'TC Outlook' information.

RSMC Wellington is continuing to provide useful guidance on potentially heavy rain and/or strong winds and/or large waves, possibly hinting at tropical cyclone formation, on day 4 and day 5 to supplement, Nadi's 3-day TC Outlook.

In the absence of radar and a good network of rain gauges, satellite hydro-estimators provide the only tool for monitoring the environment closely and helping with the forecasting of short period rainfalls.

NMHSs with an independent forecasting capability have been encouraged to issue a separate non-tropical cyclone related heavy rain forecast/warning for rainfall satisfying specific criteria. So far, Vanuatu has been issuing such forecasts and Fiji has been trialling a new product over the last 3-4 months.

1. APPENDICES

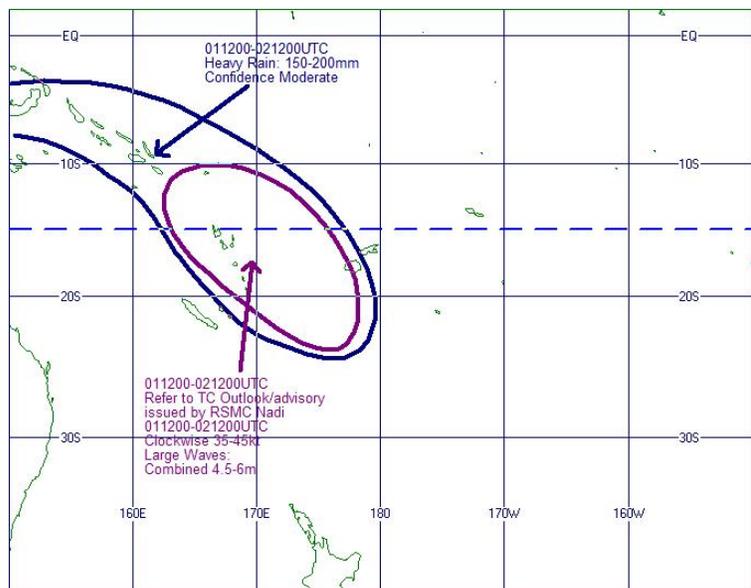
A. Tropical cyclone events

The following are South Pacific Guidance charts leading up to the naming of tropical cyclone Daphne in April.

DAPHNE: Named 0100 UTC on 2-April-2012

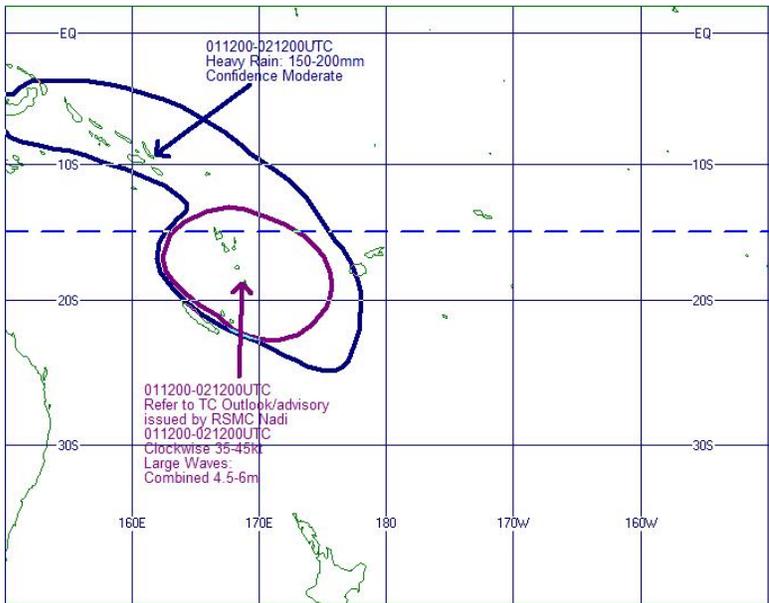
Comment: Daphne was picked up in the TC Outlooks about 2 days before it was named. The South Pacific Guidance charts displayed a combination of heavy rain/strong wind/large waves from 3 days out.

1500 UTC issue on 31-March-2012 (Day before Daphne was named)



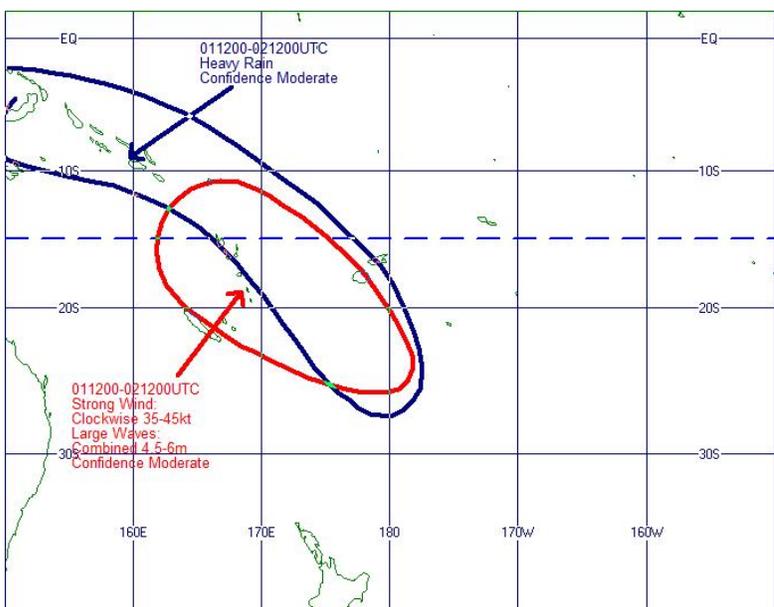
TC Outlook	Yes	
Rain	150-200mm	Mod
Wind	35-45kt	
Waves	4.5-6m	

0300 UTC issue on 31-March-2012 (2 days before Daphne was named)



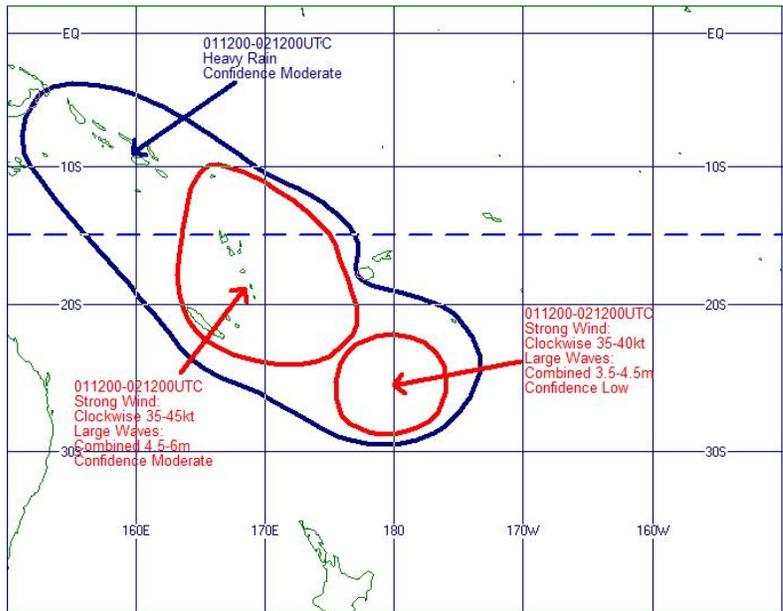
TC Outlook	Yes	
Rain	150-200mm	Mod
Wind	35-45kt	
Waves	4.5-6m	

1500 UTC issue on 30-March-2012 (2 days before Daphne was named)



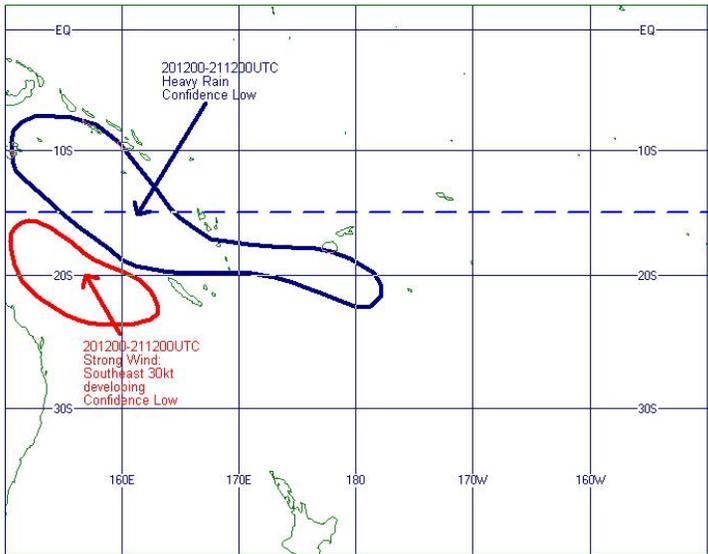
TC Outlook	No	
Rain	Heavy	Mod
Wind	35-45kt	Mod
Waves	4.5-6m	Mod

1500 UTC issue on 29-March-2012 (3 days before Daphne was named)



TC Outlook	No	
Rain	Heavy	Mod
Wind	35-45kt	Mod
Waves	4.5-6m	Mod

1500 UTC issue on 28-March-2012 (4 days before Daphne was named)



TC Outlook	No	
Rain	Heavy	Low
Wind	30kt	Low

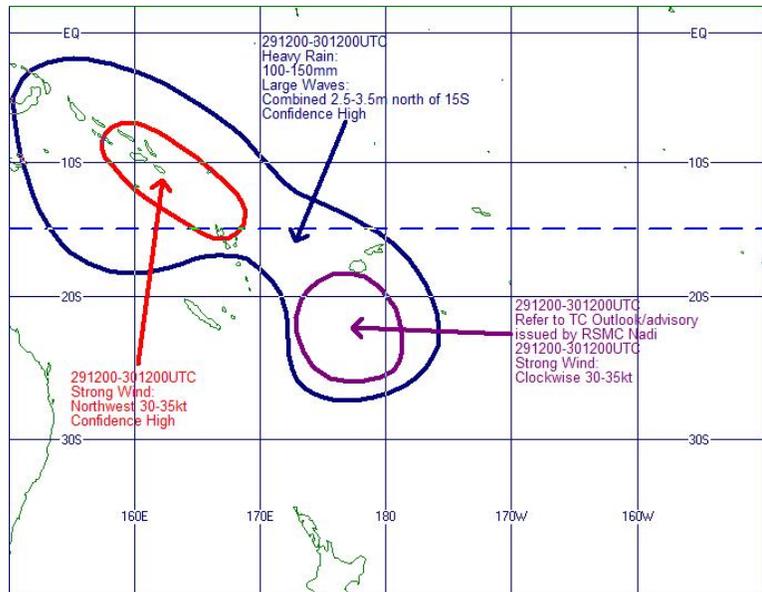
B. Non-tropical cyclone events

- **EXTREME RAINFALL and FLOODING EVENT over FIJI: 29-March to 1-April UTC – 591mm (nearly 700mm in 3 days at Nadi Airport including near 300mm in first 12 hours of the event to 0000 UTC on 30-March-2012)**

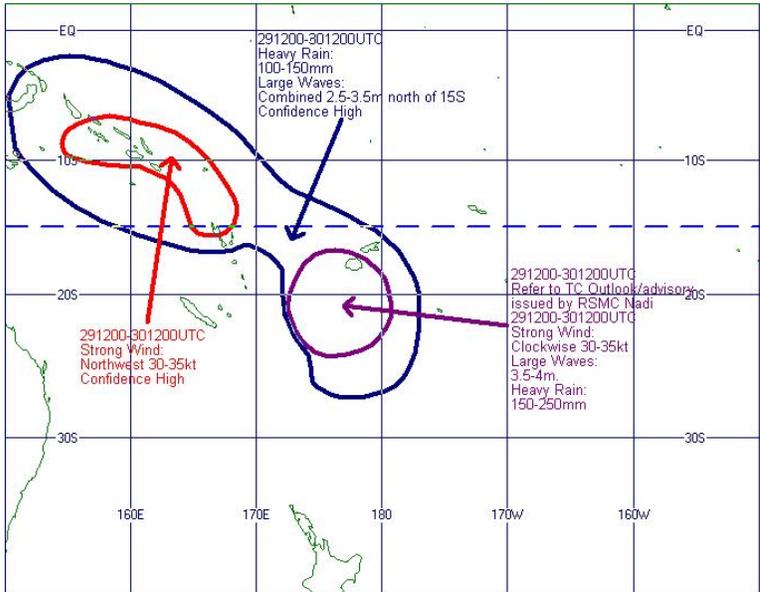
Comment: Heavy rain was forecast 4 days in advance but amounts in excess of 150mm per day were only forecast on the day the event started.

The amount of the rain which fell in the first 12 hours of the event is beyond the existing scope of SWFDDP.

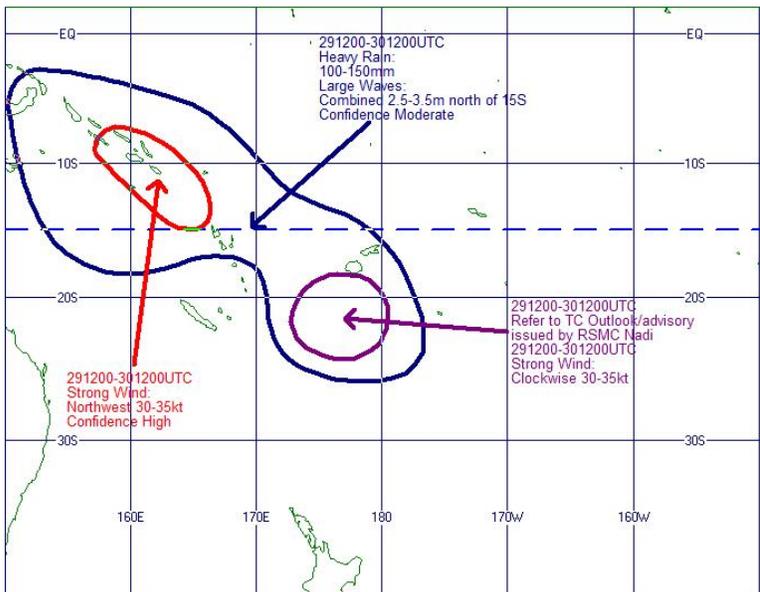
1500 UTC issue on 29-March-2012 (starting day for this event)



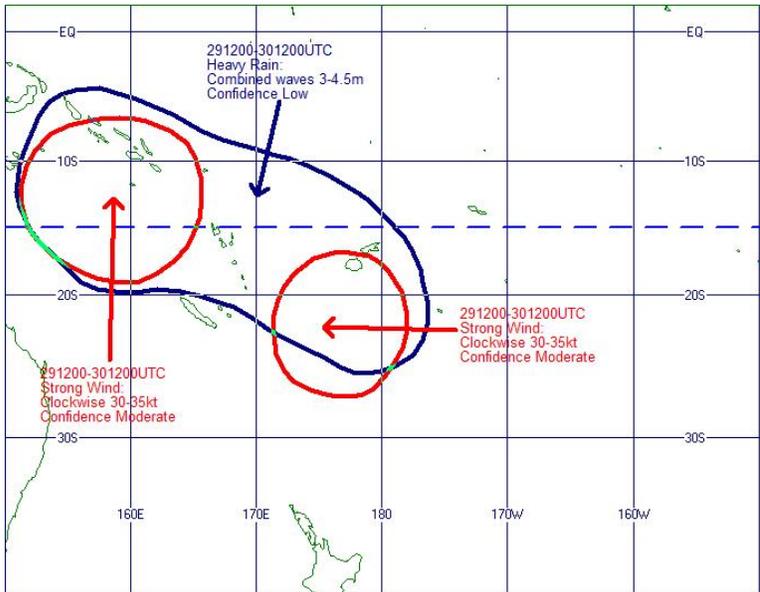
0300 UTC issue on 30-March-2012 (starting day for this event)



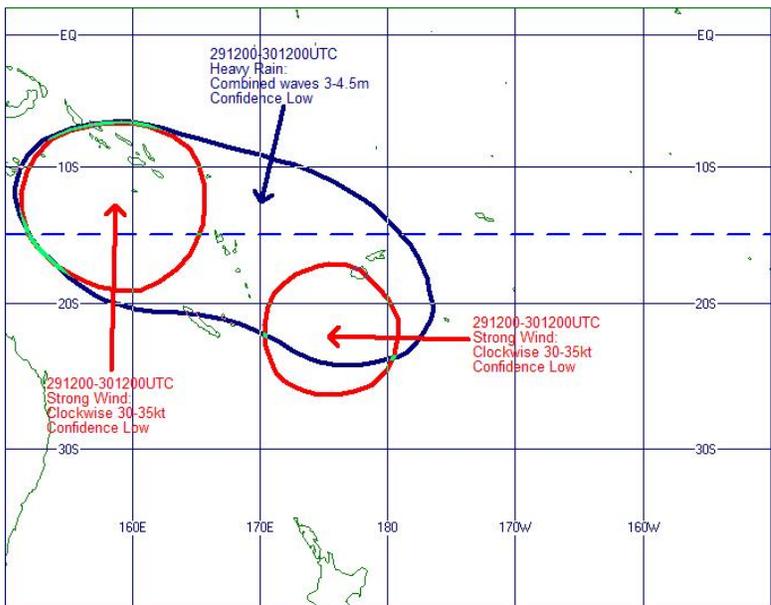
1500 UTC issue on 28-March-2012 (day before start of event)



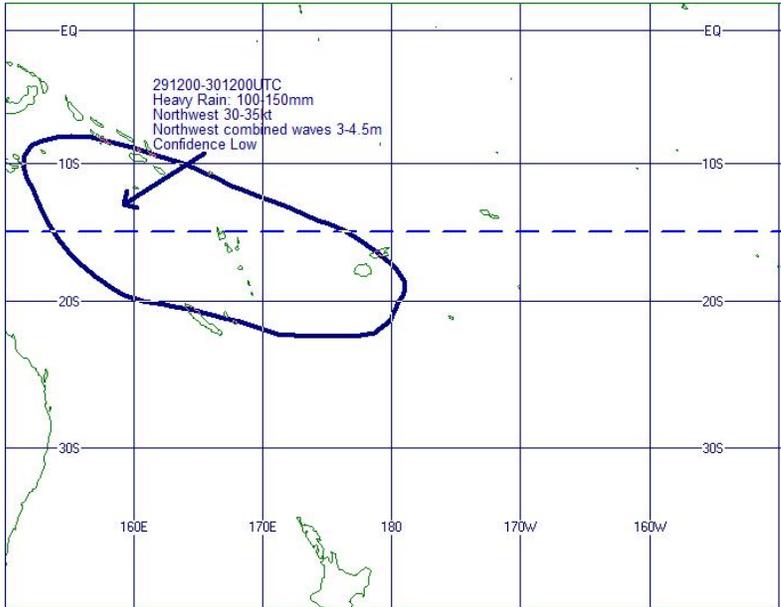
1500 UTC issue on 27-March-2012 (2 days before start of event)



1500 UTC issue on 26-March-2012 (3 days before start of event)



1500 UTC issue on 25-March-2012 (4 days before start of event)



C. Article in Samoa newspapers

LOCAL

Working to manage severe weather risks in Samoa



(L-R): James Lunny (MetService), Mullipola Ausetalia Tiliamea (SMD), Leigh Anne Eaton (NOAA), Luteru Tauvale (SMD), Henry Taiti (WMO), Eesese Ahken (SMD) and Jonathan Tunster (MetService).

By James Lunny
and Prichazo Tefele

New Zealand and United States meteorologists visited Samoa last week to provide training to help Samoa better forecast severe weather events.

Over the last two decades, Samoa has suffered serious socio-economic shocks caused by four natural disasters.

The worst of these were caused by three severe weather events, tropical cyclones Ofa in 1990, Val in 1991, Hota in 2004 and the tsunami in 2009. The World Bank in 2010 estimated the economic damage from Ofa and Val alone was US\$554 million.

The training, under the auspices of the World Meteorological Organization (WMO), was delivered by James Lunny and Jonathan Tunster, meteorologists from the Meteorological Service of New Zealand (MetService), assisted by Leigh Anne Eaton, a numerical weather

prediction modeller from the United States National Oceanic and Atmospheric Administration (NOAA). The training was financially supported by New Zealand's Ministry for the Environment and Ministry of Foreign Affairs and Trade, and by NOAA.

Hosted by the Samoa Meteorological Division (SMD), and the Ministry of Natural Resource and Environment (MNRE), the workshop was one of many initiatives supported by the Samoan Government, aimed at enhancing resilience of Samoan communities to severe weather risks. The training was designed to assist Samoa forecasters in producing timely and effective severe weather warnings and getting them out as quickly as possible to the community.

The training was held from 7-11 May at the SMD headquarters at Mulimua, with a Disaster Risk Reduction workshop held at the MNRE in Apia on 9 May. Disaster Management Office manager Filomena

Nelson and other members of the Disaster Advisory Committee met with SMD staff to perform exercises and discuss the forecasting of heavy rain, strong winds, large waves and tropical cyclones and their impacts on Samoa.

"This training again reinforces the close relationships we have with New Zealand and the United States to develop our capacity in weather forecasting," said Mullipola Ausetalia Tiliamea, Acting CEO of SMD, in his closing remarks.

The training was the second to be held in Samoa by MetService since November 2009. As well as helping to fine tune the forecasting skills of the SMD, it also will help improve the interaction and communication of severe weather warnings between the SMD, the public, government and commercial sectors.

Other participating Pacific Islands are the Cook Islands, Kiribati, Fiji, Niue, Solomon Islands, Tuvalu, Tonga and Vanuatu.