

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

REGIONAL SUBPROJECT RA V

PROGRESS REPORT N°4

For the period 1 Nov 2011 – 29 Feb 2012

(20 April 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)

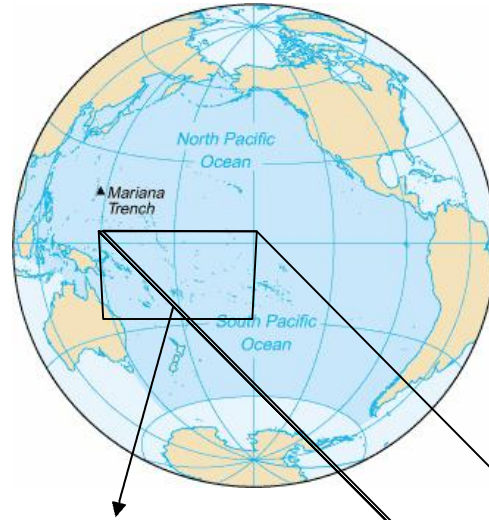
The principles and the goals of the Project were well outlined in section 1.1 of the plan. The Cascading Forecasting Process of global centres providing products through a lead RSMC to NMHSs is described in section 1.2. The overall framework of the Project in RA V is presented in section 1.3.

Full demonstration phase participants:

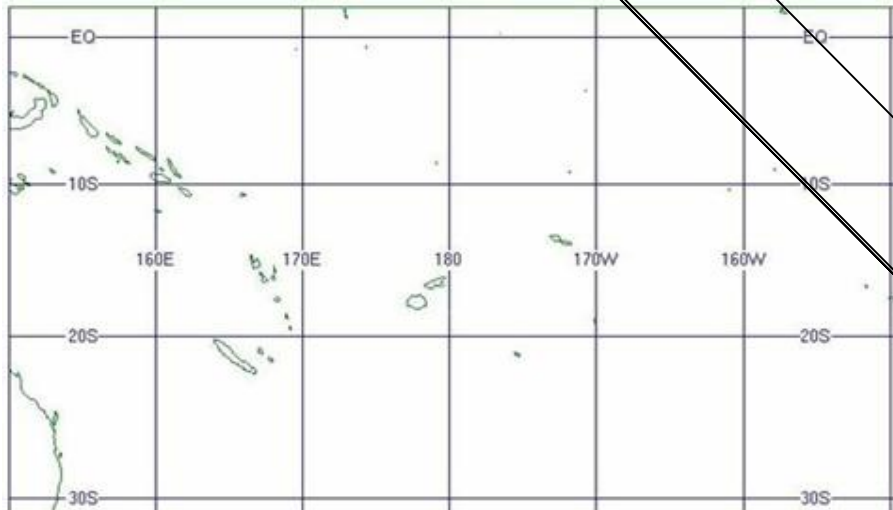
A Pilot phase involving a group of 4 participating countries in 2009/10 (Samoa, Vanuatu, Solomon Islands, and Fiji) was completed on 31 October 2010. It was followed by a full Demonstration phase in 2010/12 which includes the 4 Pilot phase NMHSs plus the following five NMHSs: Cook Islands, Niue, Kiribati,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



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



South Pacific Ocean Map (showing location of participating NMHS)

South Pacific Ocean Map



This fourth Progress Report of the full Demonstration Project spans the period 1 November 2011 to 29 February 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 they should send feedback back 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 Nov 2011 – 29 Feb 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 which described its activities, major events over the period and has begun verification of the South Pacific Guidance as outlined in this report. RSMC Darwin submitted a report describing its activities. RSMC Nadi did not submit a report.

²No NMHS has presented formal verifications of their warnings yet

³ No NMHS has presented a case study for the period

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 north of 15S, and \geq 3.5m

From 1 November 2011 to 29 February 2012, a total of 1210 South Pacific Guidance charts were produced by RSMC Wellington Lead meteorologists and posted on MetConnect Pacific. Only 20% of these charts contained NIL SIG. The rest contained guidance including Heavy Rain, 87%; Large Waves, 56%; Strong Wind, 35% and TC references, 22%.

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, Vanuatu, Fiji and Tonga signifying the location and persistent nature of the South Pacific Convergence Zone (SPCZ) over this period. Kiribati's

guidance was exclusively for 'Large waves' originating from long period north or north-easterly swells from the North Pacific Ocean.

MetConnect Pacific: The website operated continuously with no outages throughout this reporting period (1 November to 29 February 2012).

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 November 2011 to 29 February 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 and its vortex tracker was implemented in November 2011. Track bulletins are now being sent to RSMC Nadi for use in TC track forecasts, and ACCESS-TC charts and tracks are available on the RSMC Darwin web page.

Parallel trials of an upgraded version of the ACCESS NWP model suite (the Australian Parallel Suite 1 - APS1) are continuing, in preparation for implementation early in 2012. It is planned to replace the existing ACCESS-G model (80 km resolution) with a higher resolution (40 km) equivalent on 28 March 2012. The tropical model ACCESS-T will be replaced in mid-2012 with a 12 km resolution regional model, ACCESS-R12, for the Australian region only. After this transition, the existing charts produced for the SWFDDP from ACCESS-T will be produced from the new ACCESS-G model, which has a similar horizontal resolution.

2.3 RSMC Nadi

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

RSMC Nadi produces tropical cyclone alerts, warnings, advisory bulletins, tropical cyclone Outlook and track and threat maps for the Southwest Pacific and Southeast Indian Ocean and Tropical Disturbance Summaries.

In addition RSMC Nadi produces Special Weather Bulletins and forecasts & warnings for damaging swell for Fiji, Tonga, Cook Islands, Niue, Tuvalu, Kiribati, Tokelau, Nauru.

2.4 Products from global centres:

ECMWF: The ECMWF products continued without interruption through this time period and were well received by the forecasters.

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

JMA: JMA has continued to provide products throughout the period.

Other centres:

Steve Ready has continued to liaise with Ray Tanabe, the Director of the Central Pacific Hurricane Center about USA progress in getting the WRF model to run over the South Pacific area. At this stage, the USA is likely to provide images from WRF12km run over the entire SWFDDP domain as well as a WRF 4km run over a smaller domain, including Samoa and Niue. When more is known about these projects the participating NMHS's will be informed

3. Summary of the severe weather events 1 Nov to 29 Feb 2012

3.1 Severe Weather Events reported by RSMC Wellington⁺:

Tropical cyclones

Three tropical cyclones were reported:

- **Fina** was named at 1500 UTC on 21 December and maintained its tropical cyclone status for just under 24 hours before it was reclassified. Its associated cloud band passed over New Caledonia on 24 December causing torrential rain over the south-eastern end of La Grande Terre
- **Jasmine** was named on 4 February UTC. Responsibility passed from Brisbane to Nadi to Wellington and back to Nadi again after Jasmine shifted to north of 25°South. It passed over or close to southern Vanuatu and southern Tonga. It remained a tropical cyclone for 12 days.
- **Cyril** was named at 1800 UTC on 6 February and continued as a tropical cyclone until it was reclassified at 1800 UTC on 8 February. It was located close to central parts of Tonga during its early stages. Responsibility passed from Nadi to Wellington after Cyril crossed the 25°South boundary.

Other weather systems

The heavy rain events have been displayed in the following tables. Refer to the legend in how to interpret the data. The criteria used by participating countries don't necessarily match those used in the production of the South Pacific Guidance (SPG) charts.

HEAVY RAIN

Month		November			December		
Target days (UTC)	15	16-17		4, 6-7	19-20	28-29	
Solomon Islands							
Vanuatu							
Kiribati							
Tuvalu	148mm*** (4,3,2,1,0)						
Fiji	157mm (4,3,2,1,0)	139mm (4,3,2,1,0)			127mm (3,2,1)		
Samoa	86mm			<u>118mm</u> (NIS)			
Tonga		209mm (4,3,2,1,0)				130mm (4,3,2,1,0)	
Niue				83mm		180mm (4,3,2,1,0)	
Cook Islands						110mm (4,3,2,1,0)	

Month	January					
Target days (UTC)	2-3	6-9	19-20	22-25	29-31	
Solomon Islands					<u>138mm**</u> (4.3.2.1.0)	
Vanuatu	-	-	-	-	<u>138mm</u> (4.3.2.1.0)	
Kiribati						
Tuvalu						
Fiji		160mm (4,3,2,1,0)		<u>591mm**</u> (4.3.2.1.0)	-	
Samoa	<u>85mm</u>	<u>83mm</u>	<u>251mm</u> (4.3.2.1.0)			
Tonga		156mm (2,1,0)				
Niue		87mm	92mm		95mm	
Cook Islands						

Month	February			
Target days (UTC)	1-3	4-6	8-10	22

Solomon Islands				
Vanuatu	239mm (3,2,1,0)		149mm	
Kiribati				
Tuvalu				
Fiji	-	-	123mm (4,3,2,1,0)	
Samoa		<u>171mm (1,0)</u>		
Tonga				
Niue				93mm (NIS)
Cook Islands				

* = 2 day rainfall and ** = 3 day rainfall

157mm (4,3,2,1,0) = Max observed 24hr rain = 157mm. Event appeared on SPG charts from 4 days out to actual day (= 0). Underlined means widespread

If the rainfall total is prefixed with an E (e.g. E100mm), that means it has been estimated.

125mm (NIS) = Max observed 24 hour rainfall = 125mm. Guidance Not In SPG charts (NIS). Not underlined means localised

LARGE WAVES

Observations from both Niue and the Cook Islands indicate there was a significant wave event (Combined northwest sea and swell) during 3-7 February.

Month	November	December	January		February	
Target days (UTC)				3	4-7	7

Vanuatu				-	-			100kt Aneityum Island (4,3,2,1,0)	
Kiribati									
Tuvalu									
Fiji	<u>25kt</u> (4,3,2,1,0)				25kt (1,0)		-	-	-
Samoa				-	-		G87km/hr (4,3,2,1,0)		
Tonga				E25kt			E30kt (3,2,1,0)		E25kt
Niue							G65km/hr (3,2,1,0)		
Cook Islands									

Legend:

25kt (4,3,2,1,0) = Max 10-minute average wind in knots. Event appeared on SPG charts from 4 days out to actual day (= 0). Underlined means widespread

G87km/hr (4,3,2,1,0) = Max 3-sec gust in kilometres per hour. Event appeared on SPG charts from 4 days out to actual day (= 0). Underlined means widespread

125mm (NIS) = Max observed 24 hour rainfall = 125mm. Event Not In SPG charts (NIS). Not underlined means localised

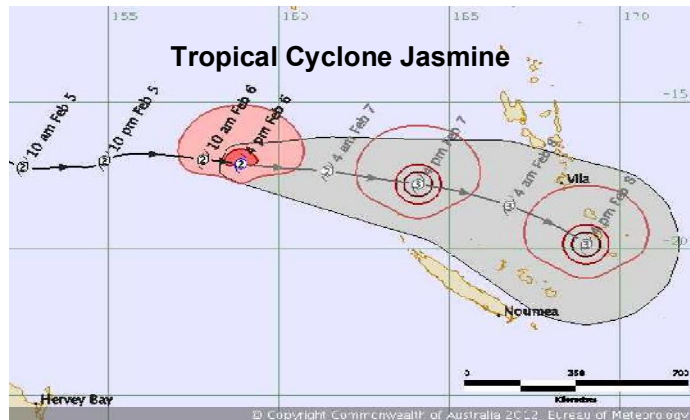
+ This list may be incomplete. The onus is on participating countries to advise RSMC Wellington of all severe weather events.

3.2 Vanuatu:

A tropical low moved over Vanuatu from 1 to 2 February 2012. 238.6 mm at Saratamata in 24 hours up to 2100UTC on 1 February 2012. In the same period 1620 mm fell at Pekoa, Santa, and 118.1 at Sola. Tropical Cyclone warnings were issued 24 hours before the event.

TC Jasmine occurred from 7 to 9 February 2012. 149.4 mm was recorded at Aneityum in the 24 hours up to 2100UTC 09 February, and 76.2 mm at White Grass in the same period. 100 Knot gusts were recorded at 0300UTC 08 February at Aneityum. Tropical Cyclone warnings were issued 48 hours before the event.

3.3 Solomon Islands



Bad weather associated with Tropical Cyclone Jasmine (category three) which was located near southeast Rennell Island and moved east-southeast away from the chain of Islands. 24 hr rainfall of 76.0mm was recorded at Henderson as of 0000UTC 30 January 2012. 24 hr rainfall of 54.6 mm was recorded at Munda, Western as of 0000UTC 31 January. Landslides occurred on White river slopes. Houses were damaged in most provinces. Food Gardens damaged by flood for 21 families in Kia, Isabel were affected. Water system at the Malu U.Clinic, Malaita was damaged.

Tropical Cyclone Watch advisories were issued for Rennell & Bellona, Makira, Temotu and the southern parts of Guadalcanal and Malaita provinces more than 24 hours in advance.

Wind Warnings of 15 to 25 knots were issued with moderate to rough seas and moderate swells and heavy rain.

3.4 Fiji:

Highlights over the period were:

- a) The SPCZ with a Tropical Disturbance (01F) moved over the Fiji group from 14 to 15 November 2011. 24 hr rainfall of 147.1 mm was recorded as of 2100 UTC 15 November, 2011. Roads, bridges were flooded. A heavy rainfall warning was issued 24 hrs in advance. 25 knots was recorded at Ono-I-Lau at 0300 UTC on 15 November. Strong wind warning was issued more than 48 hrs in advance.
- b) Frontal system affected Fiji on 17 November 2011. Roads were flooded. 24hr rainfall of 138.5mm was recorded at Navua up to 2100UTC 17 November 2012. A heavy rainfall warning was issued more than 48 hours in advance.
- c) An active trough moved slowly over the group from the 19 to the 22 December 2011. 24 hr rainfall of 125.7 mm was recorded at Koronivia up to 2100 UTC 19 December 2011. 24 hr rainfall of 127.2mm was recorded at Kadavu up to 2100 UTC 20 December 2011 and 118mm in Suva up to 2100 UTC 21 December, 2011. No damages were recorded. A heavy rainfall warning was issued 24 hours in advance.
- d) A trough of low pressure affected Fiji from 4 to 7 January 2012. 24 hr rainfall of 114 mm was recorded at Nadi up to 2100UTC 06 January, 2012. Roads, bridges, and villages were flooded. A heavy rainfall warning was issued 48 hours in advance.
- e) A trough with Tropical Depression (06F) affected Fiji from 19 to 24 January 2012. Roads, bridges, major rivers, and villages were flooded. Landslides as well as 6

deaths were reported. The estimated total cost of the damages is over \$30 million. 24 hr rainfall of 468.2mm was recorded at Ba Mill up to of 2100UTC 25 January, 2012. 24 hr rainfall of 291.9mm was recorded at Nadi up to of 2100UTC 24 January and 260.0mm in the same period at Lautoka Mill. Heavy rainfall warnings were issued 48 hours in advance. A strong wind warning was issued 24 hours in advance – winds 25-28 knots were observed at Ono-i-Lau in period 0000 UTC 21 January to 2100 UTC 22 January . No wind damage was reported

- f) The Tropical Depression 10F passed through the southern parts of Fiji on 5 February 2012. A gale force wind warning was issued 6 hours before the vent. 35 knot winds were recorded at Southern Lau. No damages were recorded. An active trough remains slow moving to the west of the group on 10 February 2012. 24 hour rainfall of 122.6mm at Udu was recorded on 10 February, 2012. There was flooding in low lying areas.

3.5 Samoa

November 2011- Samoa lay between two weather systems on 26 and 27 November, a convergence to the southwest and a trough to the northeast associated with broad band of cloud that produced widespread rain heavy at times. No advisory/warning was forecast for this event. It was very short lived (1200 UTC 26 November to 0600 UTC 27 November). 24 hr rainfall of 73.8mm was recorded at Apia as of 12UTC 26 November and 24 hr rainfall of 85.9 mm was recorded at Afiamalu on Upolu (central) as of 12 UTC 27 November and 67mm in the same period at Faleolo on Upolu (west)

December 2011- An active trough of low pressure lay across Samoa link to a low pressure developed to the southeast of Niue on 4 December. A trough drifted southwest on 5 December giving away to an active feeding band lies north-south over Samoa on 5 December and moved eastwards away from Samoa on 6 December. 24 hr rainfall of 111.6 mm was recorded at Nafanua on Upolu and 118 mm at Faleolo on Upolu (west) by 0000 UTC 5 December. No warning was issued.

January 2012- Heavy rainfalls were recorded three times for the month of January, the first event occurred on the 2 and 3 January from a trough line lying southeast to northwest across Samoa. 85.2 mm fell in Alaoa on Upolu (central) and 63.2 mm at Faleolo on Upolu (west) in the period 1200 UTC 2 January to 1200 UTC 3 January 2012. A heavy rainfall warning was issued early on 3 January (i.e. with a delay). There was minor road damage. The second event occurred on day 6 Jan to 9 January due to an active convergence ahead of a trough to the southwest moved northeast over the areas produced continuous rain within three days and its impact recorded on 8- 9 January. Rainfall of 83 mm was recorded at Letui from the 06 Jan to 09 January. No warning was issued. There was minor road damage Twin low pressure system to the northeast and northwest on 18 January with associated convective cloud band drifted south over Samoa and deposit tremendous amount or rain all over Samoa from 18 – 20 January. Rainfall of 251.2 mm was recorded at Alaoa on Upolu (central) from 18 – 20 January. 145.2 mm was recorded at Asau on Savai'i (west) in the same period. This event caused river flooding and flooding at low lying coastal areas. It caused a number of road blockages due to high water levels especially fords as they could not be crossed by small vehicles and children due to strong river currents. This event also caused two fatalities in the big island of Savaii. Heavy rainfall warnings were issued early on 19 January (13 hour delay).

February 2012- Heavy precipitation and strong winds directly related to an active convective system over Samoa that associated with range of low pressure systems migrate from west to east to the south of Samoa from the 1-9 of February. Tropical Cyclone Jasmine & Tropical Cyclone Cyril also contribute in providing wet and unsettled conditions for this period. Rainfall of 171.1 mm was recorded at Afiamalu on Upolu (central north) on 6 February 2012 and 119.2 at Lepa on Upolu (east) in the same period. There was minor damage to roads. A rainfall warning (and strong wind) warning was issued on 2 February.

3.6 Cook Islands:

There were 2 severe weather events occurred during the period of this report. On 28 December, 2012 there was heavy precipitation associated with Tropical Disturbance 02F. 24 hr rainfall of 109.6mm was recorded at of Rarotonga from 1200UTC 28 December to 1200UTC 29 December 2011. There was flooding in low lying areas. No warnings were issued.

On 02 February high seas up to 5m were observed at Avarua Urban, Rarotonga. These waves were associated with a series of low pressure systems to the north of Rarotonga along an active trough line. There was flooding in low lying areas along the coast. No warnings were issued.

3.6 Tuvalu:

148.2mm was recorded at Funafuti in the 12 hours from 2100UTC on 11 Nov to 0900UTC on 12-Nov-2011. No warnings were issued however heavy rainfall was included in the 3 day outlook. There was flooding in low lying areas in capital Funafuti.

3.7 Kiribati:

No severe weather or significant wave events were reported.

3.8 Niue:

November 2011: No severe weather observed for the month of November.

December 2012: 24 hr rainfalls of 83.0mm was recorded at Hanan Airport, Alofi from 2000UTC 05 December to 2000UTC 06 December. No warnings were issued and no damages reported.

From 1800UTC 27 December to 1800UTC 28 December there was an active trough of low pressure in the vicinity of Niue which brought heavy rainfall for the island. Hanan Airport, Alofi recorded 61.4 mm and Fulupo, Liku 179.9 mm for the 24 hours period ending 2000 UTC 28 December 2011. A heavy rainfall warning was issued by Nadi 12 hours in advance. No damages were observed.

January 2012: An active trough affected most of the island for the month of January and produced heavy rainfall for both Liku and Alofi. From 2000UTC 05 January to 2000 UTC to 2000 UTC 06 January, Liku recorded 86.7 mm and Alofi 85.0 mm. A heavy rainfall was issued by Nadi 24 hours in advance. No damages were observed.

From 2000 UTC 18 January to 2000 UTC 19 January rainfall of 91.8 mm was recorded at Liku and 62.6mm at Alofi. A warning was issued 6 hours in advance. No damages were observed.

From 2000 UTC 27 January to 2000 UTC 28 January, rainfall of 95.0 mm was recorded at Liku and 61.9 mm at Alofi. A warning was issued by Nadi 24 hours in advance. No damages were observed.

February 2012: Tropical Cyclone Cyril affected Niue on 06 February. A maximum gust of 65 kilometres per hour was recorded at Hanan Airport 2330 UTC 06 February. Wave heights from 3.0 to 4.0 metres observed during the afternoon at Sir Roberts wharf at Alofi. 24 hr rainfall of 85 mm of rain was recorded at Hanan Airport by 2000UTC 07 February. A Special Weather Bulletin was issued by RSMC Nadi 2047 UTC 06 February and was cancelled on 0830 UTC 07 February. A Blue alert was issued on 2230 UTC 06 February and was cancelled on 1700UTC 07 February. No damages reported.

From 1740 UTC 22 February to 0200 UTC 23 February 92.8 mm of rain was recorded at Hanan Airport. No warnings were issued. No damages were observed.

3.9 Tonga

A strong wind warning was issued for 1200UTC on 14 November to 1200UTC 15 November. No wind near 25 knots was observed in the Island group

Rainfall of 131.2mm/24 hours was recorded at Fua'amotu airport 0600 UTC 15 November to 0600UTC 16 November 2011. A heavy rainfall warning was issued 7 hours before the start of the event. Flash flooding was observed.

Rainfall of 96.8mm/8 hr was recorded at Tongatapu 2300 23 December to 0600UTC 24 December 2012. A heavy rainfall warning was issued for Fua'amotu (not Tongatapu) 6 hours earlier.

Rainfall of 129.6mm/24hr was recorded at Niuafuou from 0000 UTC 27 December to 0000 UTC 28 December, 2011. A rainfall warning was issued with a little delay.

Rainfall of 156.2mm/24 hrs was recorded at Vavau from 0600 UTC 06 January to 0000UTC 07 January. A heavy rainfall warning was issued 14 hours in advance. Flash flooding was observed.

Rainfall of 179.0mm /24 hrs was recorded at Haapai from 0800UTC 27 January to 0000 28 January . A heavy rainfall warning was issued 16 hours in advance. Flash flooding was observed.

Tropical cyclone Cyril affected Tonga from 4 to 6 February. Rainfall of 111.7 mm/24hr was recorded at Tongatapu from 1200UTC 04 February to 1200 05 February A heavy rainfall warning was issued 5 hours in advance. Roads and villages were flooded. Winds of 81km/h were recorded at Fua'amotu 2100UTC 05 February. A strong wind warning was issued 5 hours in advance.

Again with tropical cyclone Cyril, 111 km/hr winds were observed at Vavau at 1900 UTC 06 February. There was 5 hours advance warning. There was damage to vegetation.

With Tropical Cyclone Jasmine 100 km/h winds were observed at Fua'amotu at 0500UTC 14 February, 2012. There was damage to vegetation and flash flooding. Warnings were issued 35 hours in advance.

4. Comments about the SPG and the NWP products.

RSMC Wellington:

US Satellite hydro-estimation data are also 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 $\geq 100\text{mm}$ 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 $\geq 2.5\text{m}$, north of 15°S and $\geq 3.5\text{m}$, 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. Ensemble forecasts from the GFS and the ECMWF were also generally useful especially meteograms from the ECMWF.

Samoa: SPG was always useful not only in determining the existing weather systems that produced such events but also to guide them in making quick forecast decisions. Occasionally the guidance was misleading indicating potential events that were away from the actual spot. The products from the NWP centres 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 were very useful.

As mentioned in the previous report, Access-T proved to be popular among the Vanuatu forecasters, particularly for localised events.

SIMS:

The SPG charts provided by RSMC Wellington were useful. For Jasmine the SPG forecasts were for 150-200mm/24hr whereas the observations (see above) were for less than 100mm/24hr. On the other hand there was extensive damage as noted by the National Disaster Management Office (NDMO). NWP/Ensemble products received from UKMO and/or ECMWF and/or RSMC Darwin were useful.

Niue:

Niue has found both the SPG and the model products very useful. Niue relies on Nadi for its forecasts.

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 windspeed 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. Poor connectivity issues continue to plague KMS – sometimes they could not access MetConnect Pacific and the SPG. 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 SPG is useful. Unfortunately for the storm of 28 December there were connectivity problems and the Cook Islands Met Service could not access Metconnect and the products on that day. The Cook Islands rely on Nadi for its forecasts. No warnings were issued.

Tonga: The SPG is very useful. However, the areas of potentially severe weather are quite large whereas in reality, they can be much more localised. The model output are generally quite useful for cloud amounts and precipitation and less so for temperatures. ACCESS T was quite useful in tracking the tropical disturbance that led to Jasmine. .

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.

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 or for some to issue warnings where they had not before. Fiji was able to issue warnings at least 24hrs before the events. Tuvalu was able to issue heavy precipitation warnings 24-48 hours before the event and for wind and swell events up to 3 days before the event. Tuvalu was able to issue warnings 6-18 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, Tonga and Cook Islands) reported no interactions with their DMCPA's. Fiji had several interactions with the DMCPA during a number of events. In Vanuatu the DMCPA emphasizes the importance of warnings. Niue had interactions with the DMCPA during Cyril. SIMS had no interactions except they given extensive damage summaries by the DMCPA's. Tonga briefed disaster officials twice a day during Jasmine and Cyril.

5.4 To identify gaps and areas for improvements

SIMS cited lack of experience and requires in-county training. Tonga as well as Fiji found that that SPG to overforecast the area of an event. Vanuatu and Niue would like to see improvements in forecasting localized events. Kiribati has a poor internet connection and has trouble accessing the MetConnect Pacific site. In addition Tonga would like to see more details of the timing of an event within a 24 hour period.

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

Vanuatu and Niue would like to have improvements in forecasting localized events. Tonga cited that the Access, UK and EC models tended to underforecast winds and the Access model to underforecast precipitation over Tonga.

6. Evaluation of the weather warnings:

6.1 Feedback from the public

SIMS received feedback on flooding impacts from the public. Vanuatu received positive feedback from the public with Tropical Cyclone Jasmine. In the Cook Islands the public reacted negatively that the onset time of the forecasted events in Fiji's bulletin was not clear. Otherwise there was no feedback.

6.2 Feedback from the DMCPA's

Tuvalu worked closely with their DMCPA during the two tropical cyclones. Fiji worked closely with their disaster management office. Vanuatu cites a close working relationship with their DMCPA as did Niue in setting out their Blue Alert level for Cyril. Otherwise there was no feedback.

6.3 Feedback from the Media

Tuvalu had requests for updates from the media after warnings had been issued. Samoa, Fiji Kiribati cited that their media posted warnings very quickly after they were issued. In the Cook Islands newspaper articles about the events mentioned the warnings. Otherwise, there was no feedback.

6.4 Objective verification by the NMHSs

The following is an objective verification by RSMC Wellington.

The table below shows the number of South Pacific Guidance Charts produced from 1 November 2011 to 29 February 2012 under the various categories and different countries.

During this period, a total of 1210 South Pacific Guidance charts were produced by RSMC Wellington Lead meteorologists and posted on MetConnect Pacific. Only 20% of these charts contained NIL SIG. The rest contained guidance including Heavy Rain, 87%; Large Waves, 56%; Strong Wind, 35% and TC references, 22%.

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, Vanuatu, Fiji and Tonga signifying the location and persistent nature of the South Pacific Convergence Zone (SPCZ) over this period. Kiribati's guidance was exclusively for 'Large waves' originating from long period north or north-easterly swells from the North Pacific Ocean.

Nov/Dec/Jan/Feb	SWFDD P area	Solomon Islands	Vanuatu	Kiribati	Tuvalu	Fiji	Samoa	Tonga	Niue	Cook Islands
Heavy rain	834	344	299	0	82	376	161	271	203	225
Strong wind	339	41	94	0	1	58	23	70	57	55
Large waves	541	79	117	221	2	63	40	63	45	136
TC references	207	3	54	0	0	13	0	56	25	12
Combination of one or more of above	962	345	313	221	83	380	170	311	208	293
NIL SIG	248	865	897	989	1127	830	1040	899	1002	917

Total	1210	1210	1210	1210	1210	1210	1210	1210	1210	1210
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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. This is something that will be explored further during the 2012 in-country training programme.

7. Case studies:

No NMHS submitted a case study. The Cook Island and the Solomon Islands Met service both submitted forecasts and observations impact reports that could be compiled into case study. In the Annex there are a series of images showing how the SPG behaved for the tropical cyclones and for non TV event.

It should be noted that the SPG chart for Jasmine (1500 UTC issue on 30-January-2012 (5 days before Jasmine was named)) demonstrates the effect of the dashed line along 15°South which marks the boundary for the change in the wave criteria.

Although not directly involved with SWFDDP, New Caledonia completed a case study on a significant heavy rain event on 24 and 25 December 2011 associated with a cloud band swirling around ex-tropical cyclone Fina (refer to Appendix C).

8. Conclusions:

Most NMHS's submitted reports at or near the deadline. Only Tonga was a few days late. The reports also followed the format prescribed.

In this progress report more NMHS's mentioned interactions with the DMCPA's, media or the public -notably Fiji and Vanuatu, but also Tonga and Niue. The others did not. Except for Tonga, none of the other NMHSs cited interactions with the media. Samoa, Fiji and Kiribati cited that their media reacted quickly to their warnings. The Cook Islands wrote an article about the events leading to the warnings.

SIMS mentioned a requirement for in-country training. Kiribati mentioned that they still have bandwidth problems that leads to some connection problems with the 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 represented the region at the 4th WMO SWFDP Steering group meeting in Geneva from 29 February to 2 March 2012. A copy of the Final Report will be circulated separately but there was a lot discussion about what happens after the Demonstration

phase (Phase 3) and the sustainability of the various Projects when they reach the operational Phase 4.

The second round of SWFDDP in-country training is planned to be completed before the 2012/2013 cyclone season starting with Samoa and Niue, in May; Fiji and Kiribati, in June; Cook Islands, in September; Tuvalu and Tonga, in October and Solomon Islands and Vanuatu, late October/early November.

During the 2011/2012 cyclone season, whenever a Tropical Cyclone Outlook is in force during day 1 and day 2 and no tropical cyclone has been named, Wellington forecasters have been including extra rain/wind/wave information as part of the 'TC Outlook' area instead of in a separate area (See below for the first SPG chart for tropical cyclone Fina).

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, 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.

The big challenge ahead is for NMHSs to find a way to introduce new or revised products (using values especially for rainfall and waves) based on the guidance information available on MetConnect Pacific

1. APPENDICES

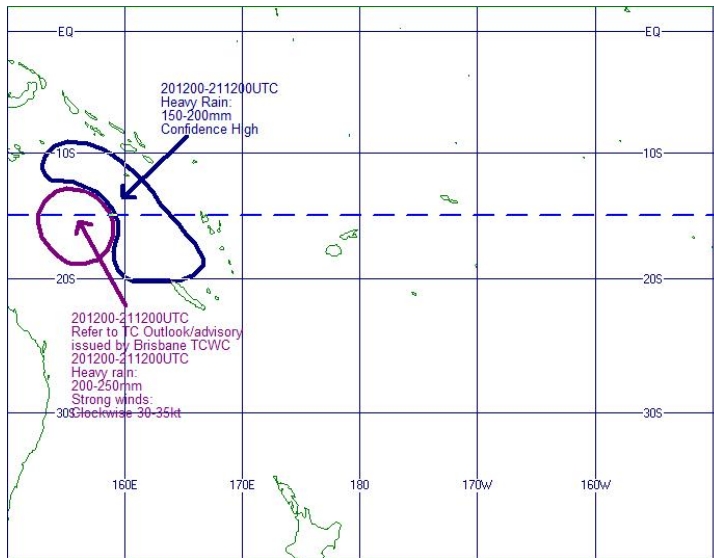
A. Tropical cyclone events

The following are South Pacific Guidance charts leading up to the naming of tropical cyclones Fina, Jasmine and Cyril.

FINA: Named 1500 UTC on 21-December-2011

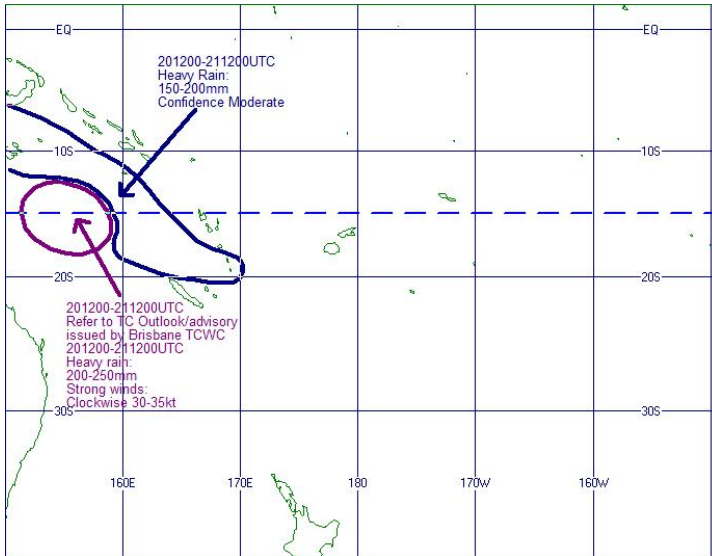
Comment: Fina was short-lived tropical cyclone and difficult to pick from more than 2 days out.

1500 UTC issue on 20-December-2012 (Day before Fina was named)



TC Outlook	Yes	
Rain	200-250mm	Mod
Wind	30-35kt	Mod

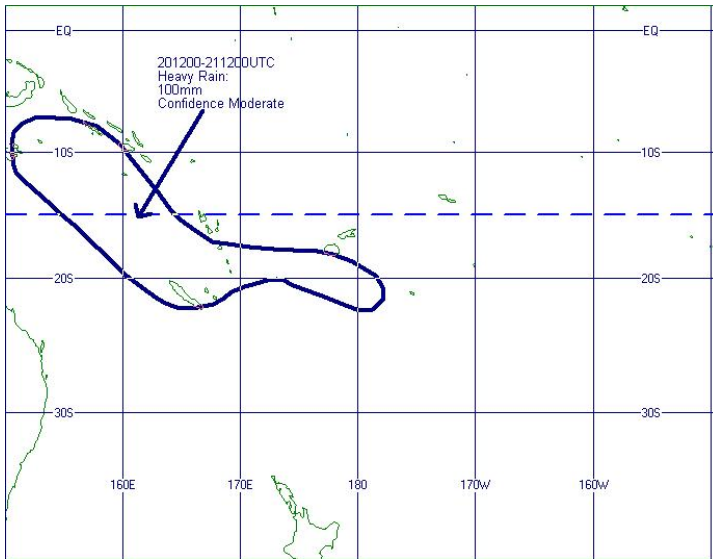
1500 UTC issue on 19-December-2012 (2 days before Fina was named)



TC Outlook	Yes	
Rain	200-250mm	Mod
Wind	30-35kt	Mod

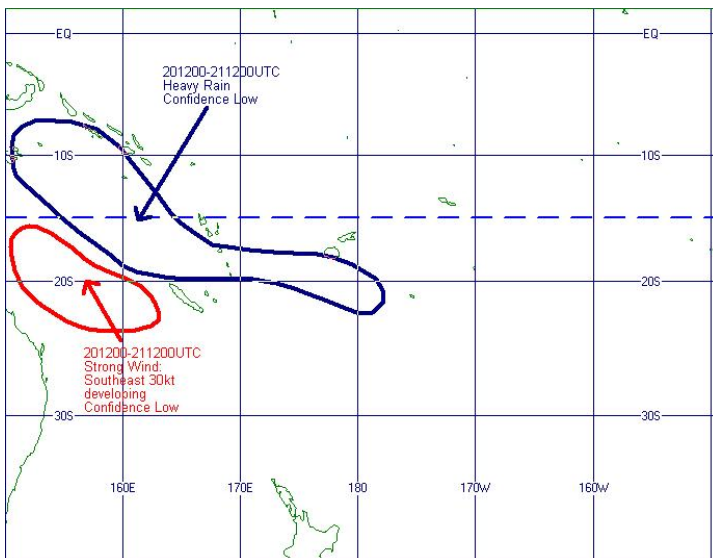
1500 UTC issue on 18-December-2012 (3 days before Fina was named)

19/AM (2 Days out)



TC Outlook	No			
Rain	100mm	Mod	Solomon Islands	Vanuatu

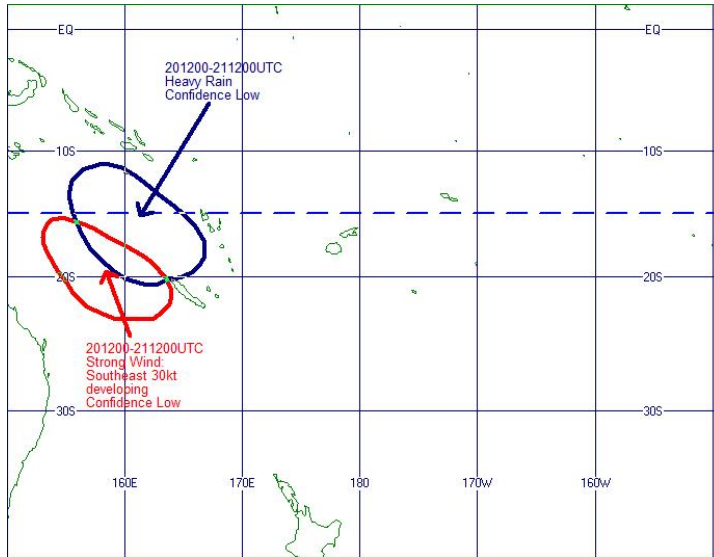
1500 UTC issue on 17-December-2012 (4 days before Fina was named)



TC Outlook	No			
Rain	Heavy	Low	Solomon	Vanuatu

			Islands	
Wind	30kt	Low		

1500 UTC issue on 16-December-2012 (5 days before Fina was named)

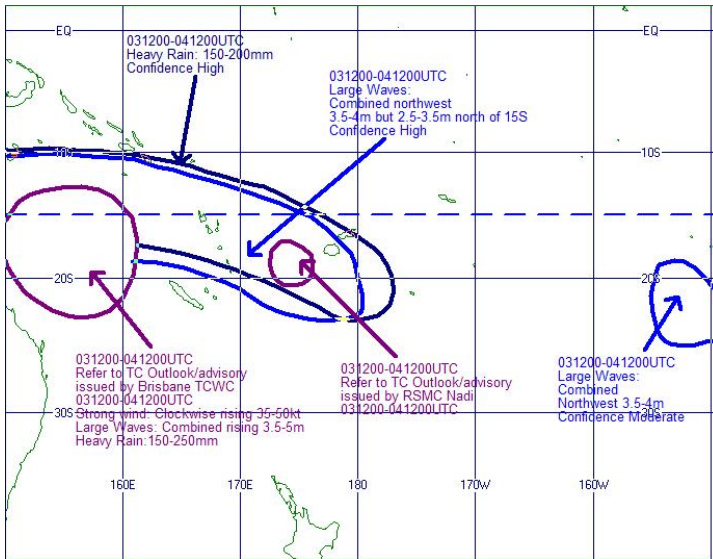


TC Outlook	No	
Rain	Heavy	Low
Wind	30kt	Low

JASMINE: Named 1200 UTC on 4-February-2012

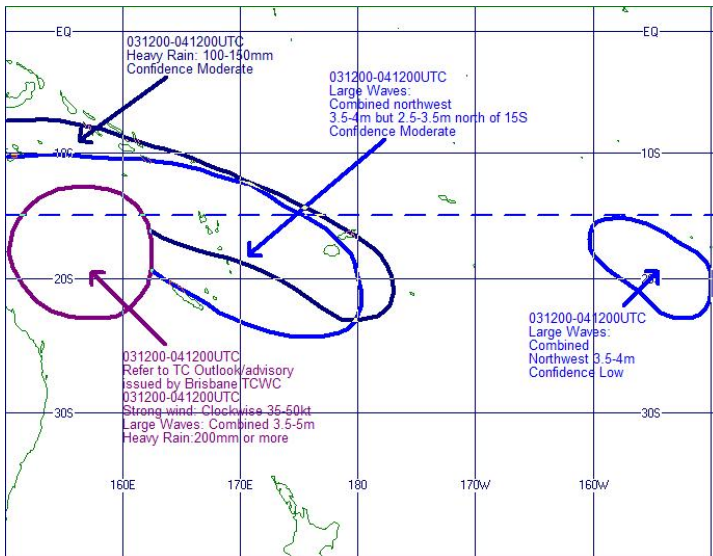
Comment: The cyclonic feature that gave rise to Jasmine was well-flagged by the global models from 5 days out.

1500 UTC issue on 3-February-2012 (Day before Jasmine was named)



TC Outlook	Yes	
Rain	150-250mm	Mod
Wind	35-50kt	Mod
Waves	3.5-5m	Mod

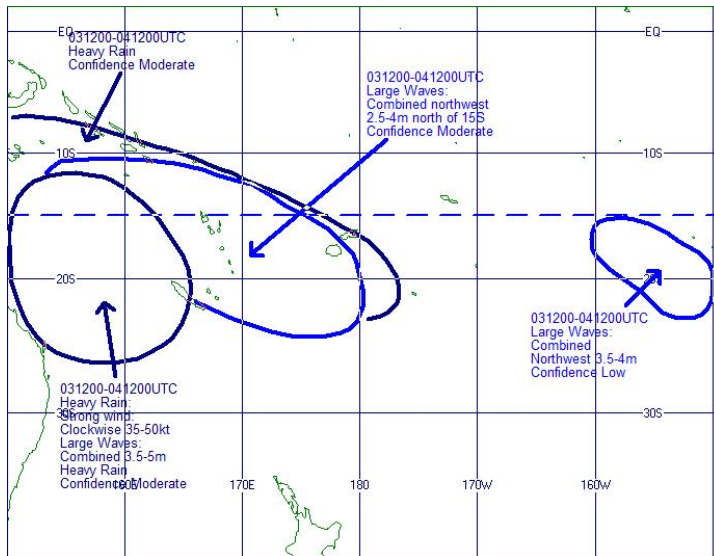
1500 UTC issue on 2-February-2012 (2 days before Jasmine was named)



TC Outlook	Yes	
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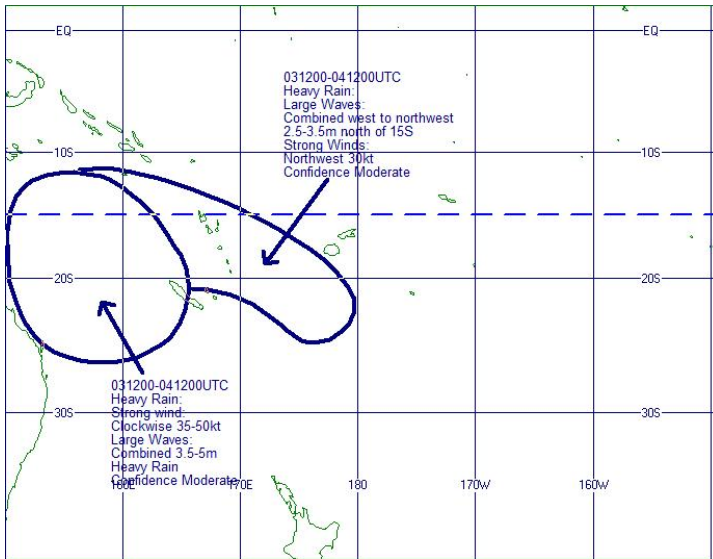
Rain	200mm+	Mod
Wind	35-50kt	Mod
Waves	3.5-5m	Mod

1500 UTC issue on 1-February-2012 (3 days before Jasmine was named)



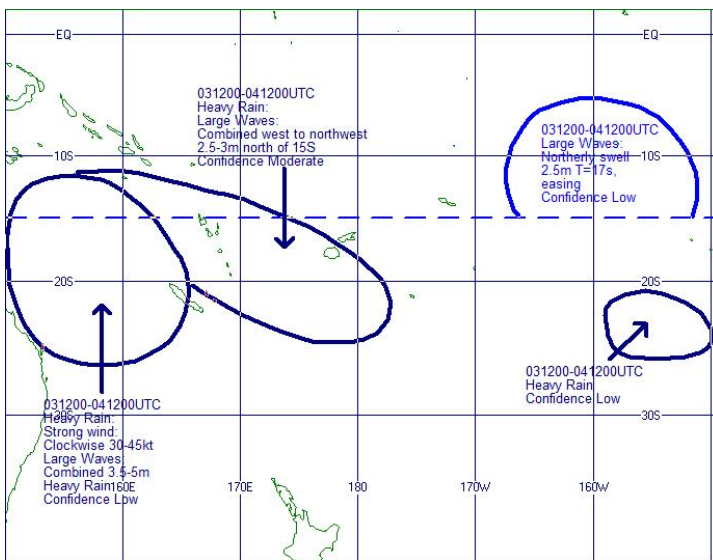
TC Outlook	No	
Rain	Heavy	Mod
Wind	35-50kt	Mod
Waves	3.5-5m	Mod

1500 UTC issue on 31-January-2012 (4 days before Jasmine was named)



TC Outlook	No	
Rain	Heavy	Mod
Wind	35-50kt	Mod
Waves	3.5-5m	Mod

1500 UTC issue on 30-January-2012 (5 days before Jasmine was named)

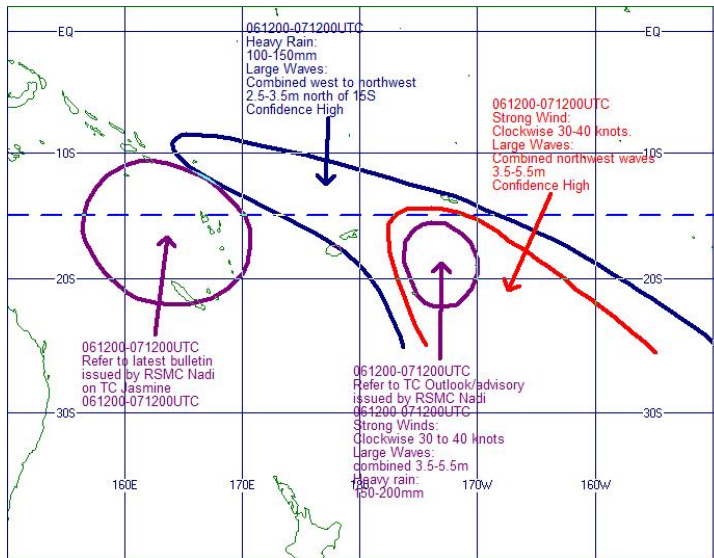


TC Outlook	No	
Rain	Heavy	Mod
Wind	35-45kt	Mod
Waves	3.5-5m	Mod

CYRIL: Named 1800 UTC on 6-February-2012

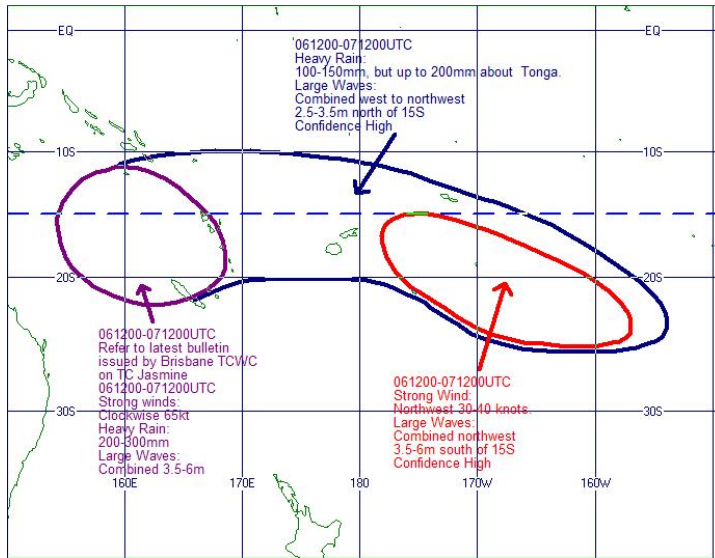
Comment: It was difficult to plot Cyril's formation from a few days out due to its small size. It wasn't until the day before it was officially named that cyclogenesis seemed a distinct possibility.

1500 UTC issue on 6-February-2012 (Few hours before Cyril was named)



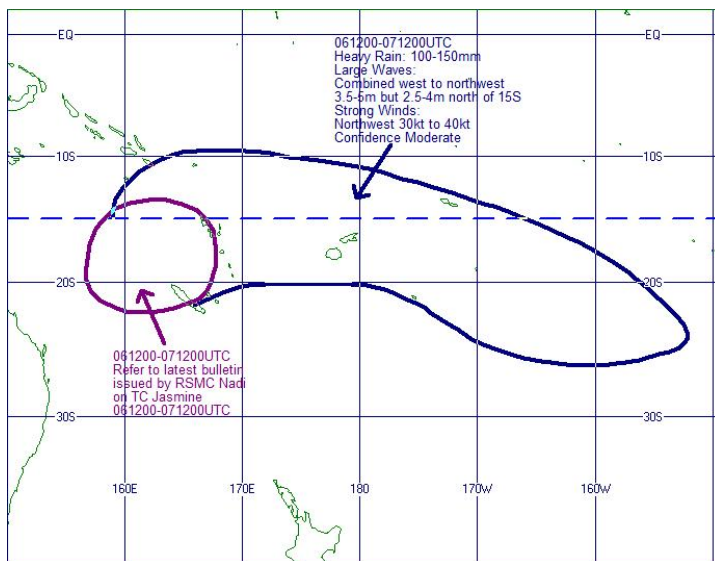
TC Outlook	Yes			
Rain	150-200mm	High	Tonga	Niue
Wind	30-40kt	High	Tonga	Niue
Waves	3.5-5m	High	Tonga	Niue

1500 UTC issue on 5-February-2012 (Day before Cyril was named)



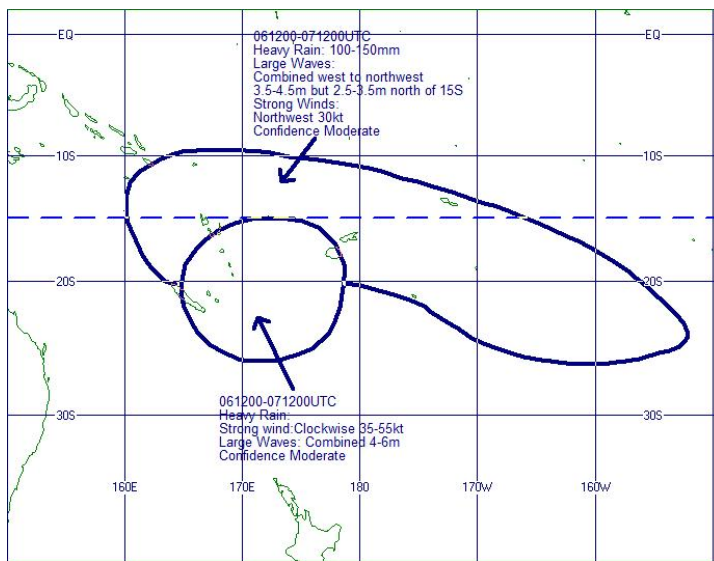
TC Outlook	No				
Rain	200mm	High	Tonga	Niue	S Cooks
Wind	30-40kt	High	Tonga	Niue	S Cooks
Waves	3.5-6m	High	Tonga	Niue	S Cooks

1500 UTC issue on 4-February-2012 (2 days before Cyril was named)



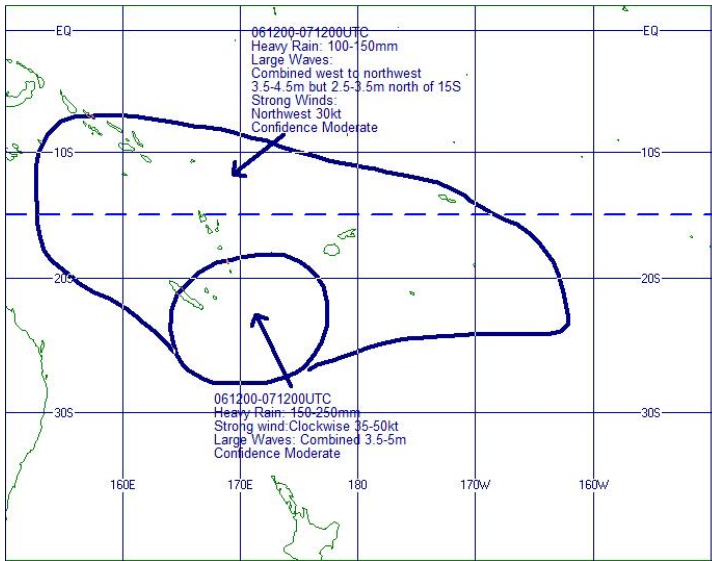
TC Outlook	No				
Rain	100-150mm	Mod	Tonga	Niue	S Cooks
Wind	30-40kt	Mod	Tonga	Niue	S Cooks
Waves	3.5-5m	Mod	Tonga	Niue	S Cooks

1500 UTC issue on 3-February-2012 (3 days before Cyril was named)



TC Outlook	No				
Rain	100-150mm	Mod	Tonga	Niue	S Cooks
Wind	30kt	Mod	Tonga	Niue	S Cooks
Waves	3.5-4.5m	Mod	Tonga	Niue	S Cooks

1500 UTC issue on 2-February-2012 (4 days before Cyril was named)



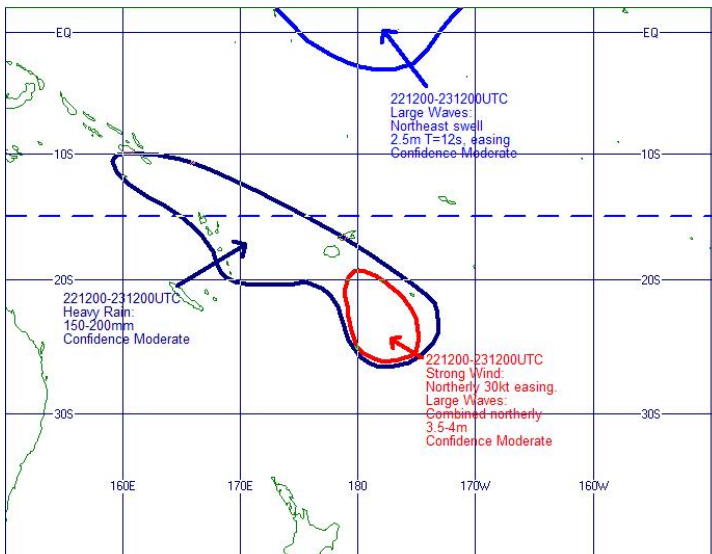
TC Outlook	No			
Rain	100-150mm	Mod	Tonga	Niue
Wind	30kt	Mod	Tonga	Niue
Waves	3.5-4.5m	Mod	Tonga	Niue

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

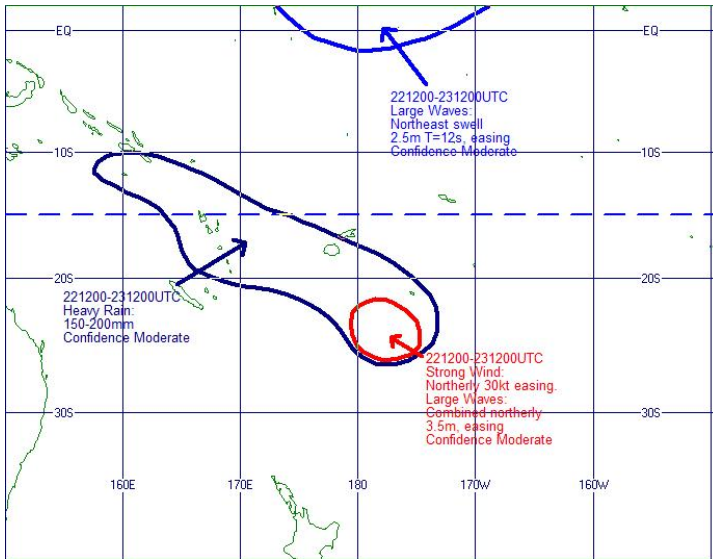
- **EXTREME RAINFALL and FLOODING EVENT over FIJI: 22-25 January – 591mm (119mm/6hr on 24th)**

Comment: Heavy rain forecast 4 days in advance. Note the mention of 150-200mm per day on the chart, the day before the event started when any warning would have been issued. This event also caused two fatalities in the big island of Savaii

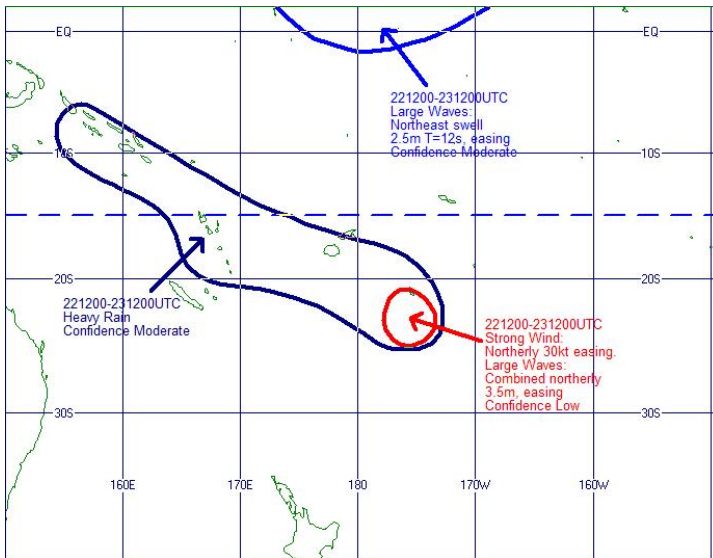
1500 UTC issue on 22-January-2012 (starting day for this event)



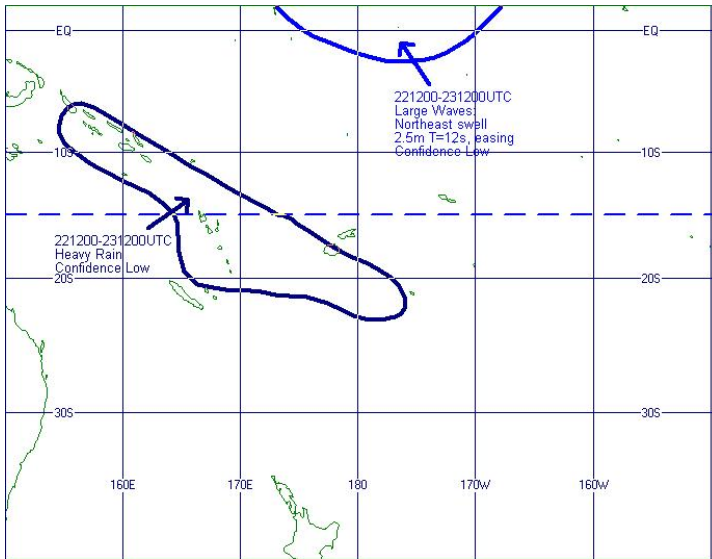
1500 UTC issue on 21-January-2012 (day before start of this event)



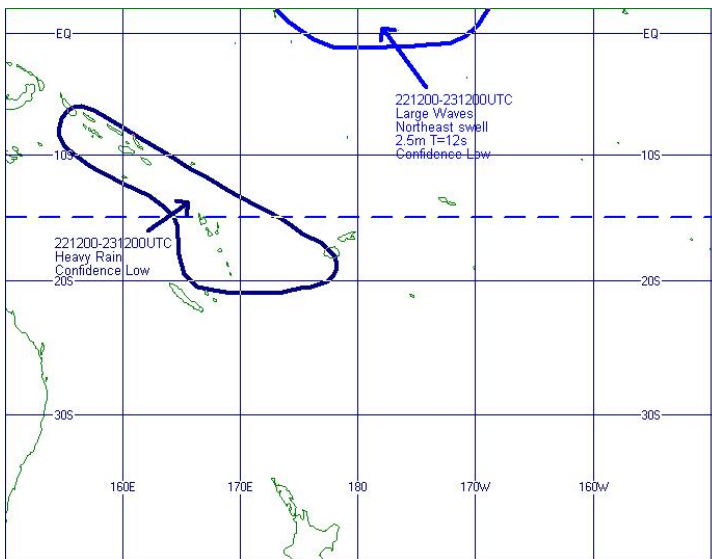
1500 UTC issue on 20-January-2012 (2 days before start of this event)



1500 UTC issue on 19-January-2012 (3 days before the start of this event)



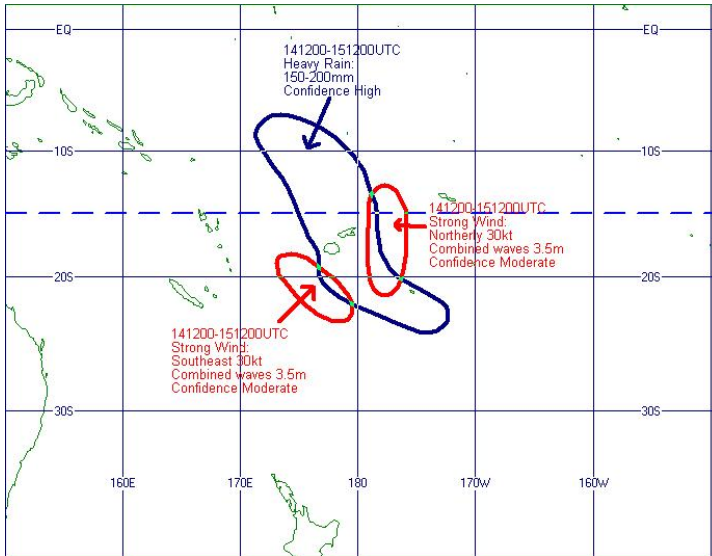
1500 UTC issue on 18-January-2012 (4 days before the start of this event)



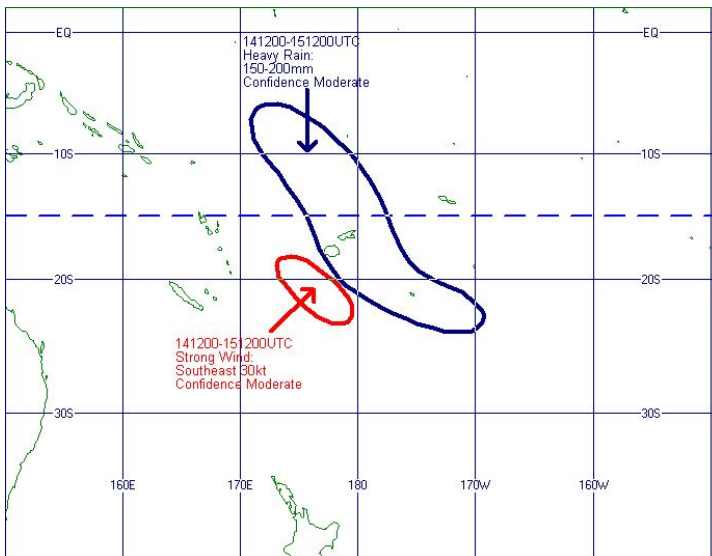
- **HIT for HEAVY RAIN and FALSE ALARM for WIND over FIJI: 14-15 November – Nabouwalu 157mm and 25kt.**

Comment: Heavy rain and strong winds forecast 4 days in advance associated with 01F. Note the mention of 150-200mm per day on the chart from 2 days before the event started..

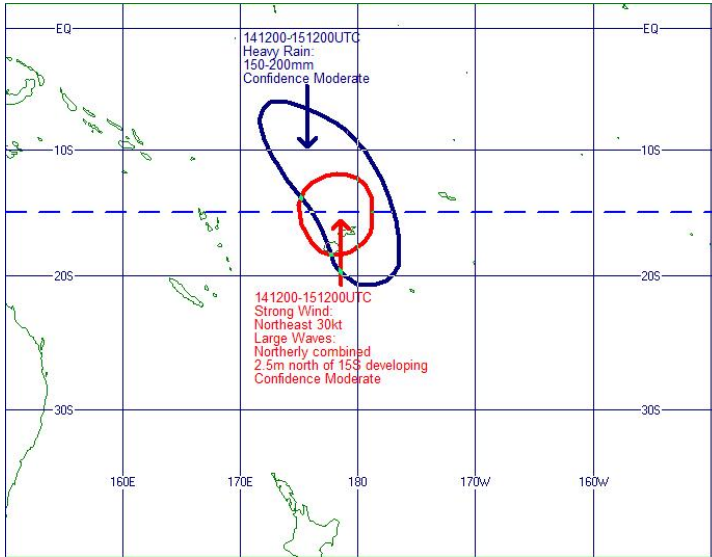
1500 UTC issue on 14-November-2012 (actual event day)



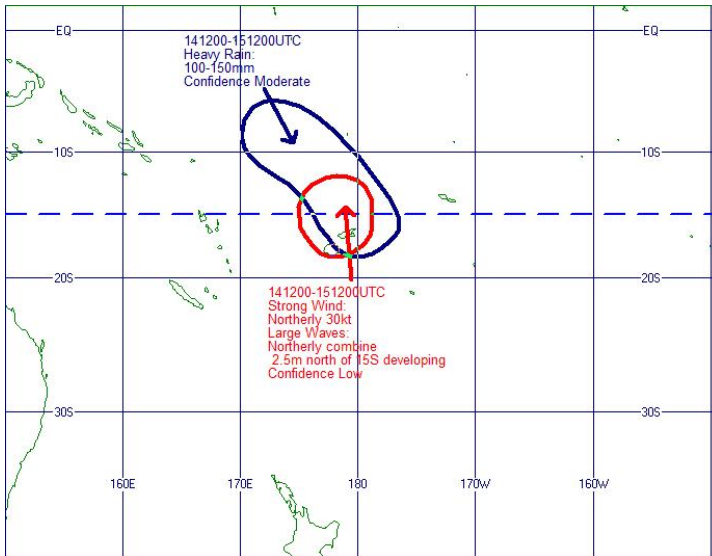
1500 UTC issue on 13-November-2012 (1 day before)



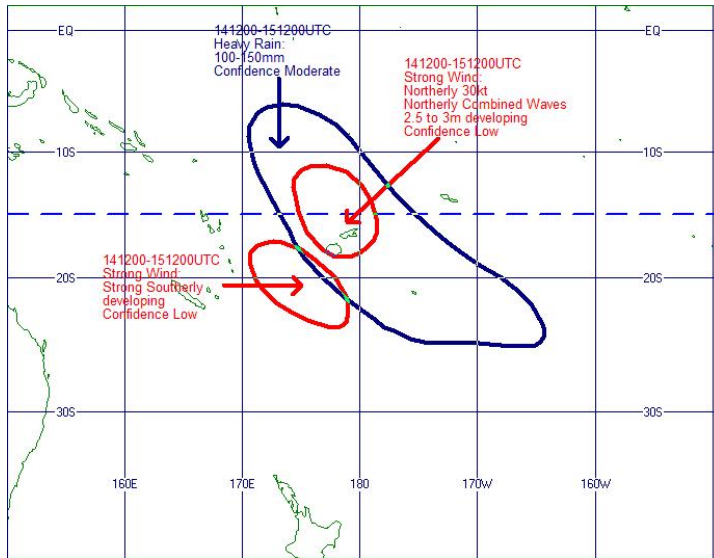
1500 UTC issue on 12-November-2012 (2 days before)



1500 UTC issue on 11-November-2012 (3 days before)



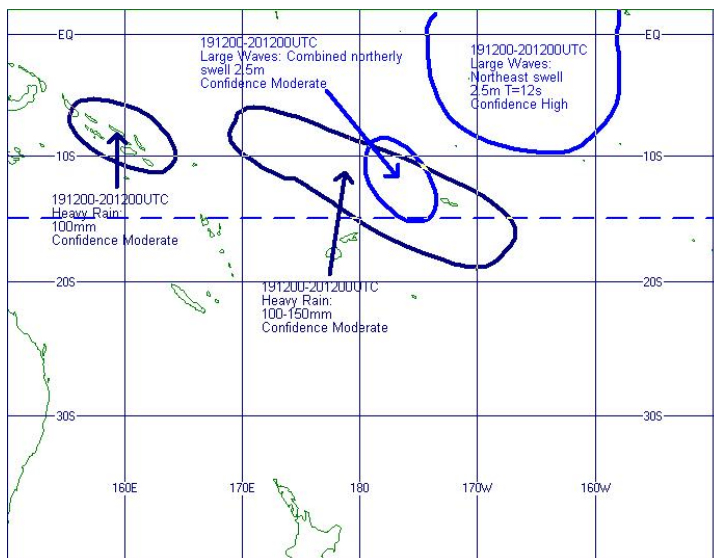
1500 UTC issue on 10-November-2012 (4 days before)



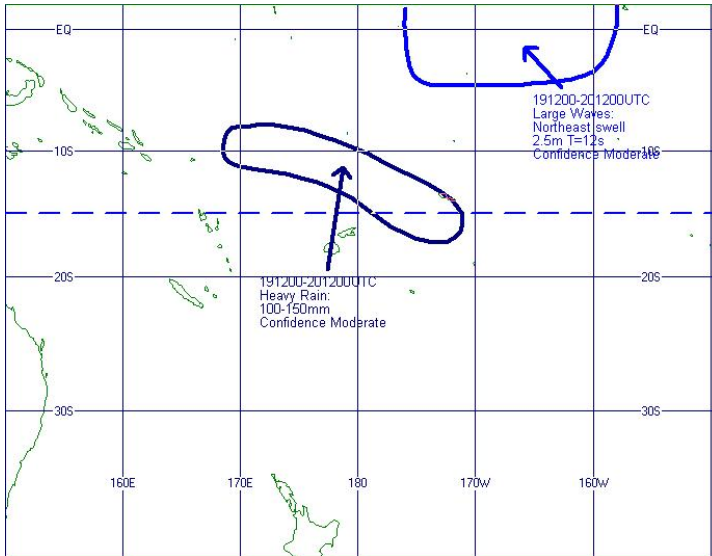
- **HEAVY RAIN and FLOODING over SAMOA: 19-20 January – Alaoa on Upolu (central) 251mm**

Comment: Heavy rain was forecast from 4 days out. The event caused 2 deaths on the big island of Savaii

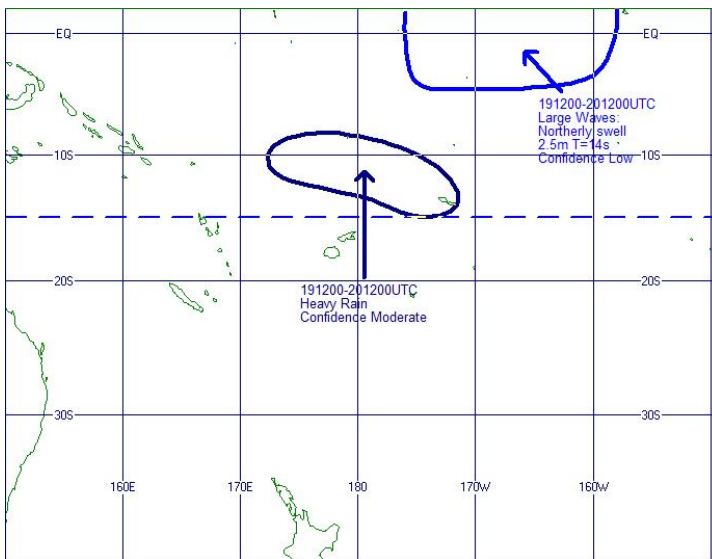
1500 UTC issue on 19-January-2012 (actual event day)



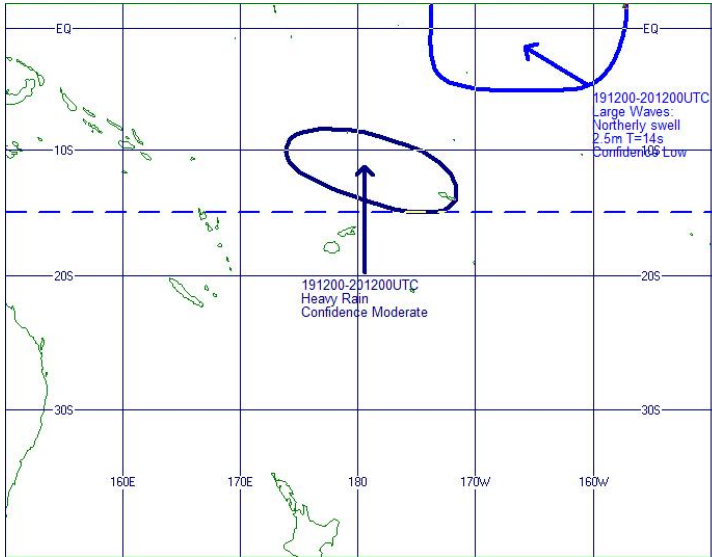
1500 UTC issue on 18-January-2012 (1 day before)



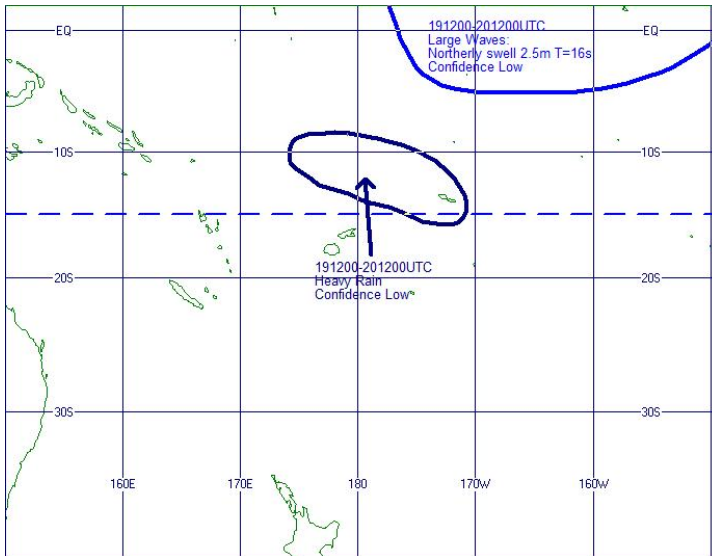
1500 UTC issue on 17-January-2012 (2 days before)



1500 UTC issue on 16-January-2012 (3 days before)



1500 UTC issue on 15-January-2012 (4 days before)



C. Case Study submitted by New Caledonia

PERIOD: 24 and 25 december 2011

INTRODUCTION (Overview of the event)

Heavy rain occurred on south east and south part of the main island during the night from 24th to 25th and in the morning of 25th.

OVERVIEW OF THE WEATHER SITUATION (leading up to and during the Event)

Northeast stream with warm and moist tropical air in lower atmosphere direct by ex-tropical cyclone Fina located southwest of New Caledonia

Trough in upper atmosphere moving from west to east south of New Caledonia

FORECASTS & WARNINGS ISSUED (by a NMHS or a NMHS on your behalf e.g. Fiji)

Yellow vigilance (or watch) for heavy rain issued by Météo France New Caledonia (level yellow is the first level of vigilance)

Thresholds for yellow vigilance:

30 à 60 mm in less than 3h,

40 à 80 mm in less than 6h,

60 à 100 mm in less than 12h,

100 à 150 mm in less than 24h,

150 à 250 mm en 48 h

PRODUCTS USED TO PREPARE THE FORECASTS & WARNINGS (South Pacific Guidance, NWP fields, Satellite imagery etc)

Models : European, French model Aladin, Ukmo model

Satellite imagery and all observations available

WHAT WAS OBSERVED (Meteorological observations, impact evidence from eye witness accounts, media & emergency management reports)

3 hours rainfall : 263 mm at Houailou(east coast),

221 mm at Goro et 187 mm at Yaté (South of main land)

24 hours rainfall: 528 mm at Houaïlou (new record for the période 1952-2011), 516 mm à Poro (near Houaïlou), 500 mm at Goro and 374 mm at Yaté.

Impacts : flooding, landslide in Houaïlou with destruction of several houses and of the new fire station.

EVALUATION OF SEVERE WEATHER FORECASTS & WARNINGS (Apply section 4 of ANNEX I to this event)

Vigilance was underestimated (such event need a red vigilance)

Thresholds for red vigilance :

- 100 mm in less than 3h,
- 150 mm in less than 6h,
- 200 mm in less than 12h,
- 300 mm in less than 24h,
- 450 mm en 48 h

SUMMARY (Any findings from this event)

The return period (I am not sure of this term) of such event is 50 years, so it is very difficult to estimate and forecast.