Volume 3: Issue: 12
December 2003

Fiji Islands Weather Summary
December 2003
Rainfall Outlook till March 2004

FIJI METEOROLOGICAL SERVICE

In Brief

Inside this issue:

Wet conditions continued in December from the later part of the previous month. Rainfall was caused by the frequent passage of troughs or convergence zones across Fiji. Particularly heavy falls from afternoon showers and thunderstorms were experienced in the interior and western parts of Viti Levu. Most of the country received average or above average rainfall except Viwa, Labasa, Savusavu and Ono-I-Lau.

The rainfall deficiency as a result of the prolonged dry spell in 2003 continues to exist in parts of the Western, Northern and Eastern Division however conditions have eased and the deficiency is expected to dissipate in the coming months.

Sea surface temperatures in the equatorial western Pacific continued to be warmer than average in December. Atmospheric conditions remained *Neutral*. Overall, conditions are expected to remain near *Neutral* throughout the Southern Hemisphere summer.

Rainfall in Fiji Islands in the next three months is expected to vary around average. This means most sites are likely to receive average rainfall, while a few may receive below average or above average rainfall.

Day-time air temperatures varied around average while night-time temperatures were mainly average to above average. A new night-time high temperature record of 26.0° C was set at Tokotoko, Navua. Relative humidity also varied around average.

Total sunshine hours were below average at Laucala Bay, Suva and Rotuma and average at Nacocolevu and Nadi Airport.

Weather Patterns

A convergence zone moved over Fiji from the northeast and brought rain to the entire country from the 1st till the 5th of December. This convergence zone moved east on the 6th and a weak ridge moved over the country from the south till the 9th. Weather during this period was characterised by brief showers about the eastern parts and afternoon showers elsewhere.

The ridge moved to the south of the country on the 10th. From the 11th till the 16th, two consecutive troughs moved across Fiji from the northeast to the west and brought rain to the northern and eastern parts. The western areas experienced heavy afternoon and evening showers and thunderstorms.

On the 17th, the second trough located to the west intensified, moved back over the country and produced widespread rain till the 19th. This trough weakened on the 20th but showers continued over the northern and eastern parts and the rest of Fiji experienced heavy afternoon showers and thunderstorms till the 23rd. Finally, the trough drifted to the north of Vanua Levu on the 24th.

Due to the trough's close proximity, Vanua Levu and Taveuni continued to experience occasional showers, while afternoon showers dominated Viti Levu's weather till the 26th. The trough drifted back over country on the 26th and this resulted in increased showers over the northern and eastern areas. Afternoon showers and thunderstorms affected the rest of the country. The trough over Fiji finally dissipated on the 29th.

A moist east to southeast airstream settled over the country from the 29th till 31st December, in response to a developing tropical disturbance to the north-east of Fiji. This resulted in brief showers over the eastern areas and afternoon showers elsewhere.

The SPCZ remained close to Rotuma during December. The island received rainfall through most of the month.

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TABLE 1: Rainfall from October to December 2003

Station	Actual Rainfall (mm)	Has rainfall in the last three months been below average, average or above average?	No. of Rain days in October (% of total rain)	No. of Rain days in November (% of total rain)	No. of Rain days in December (% of total rain)
Penang Mill	424.8	Average	02 (11)	11 (19)	20 (70)
Monasavu Dam	1349.9	Average	16 (20)	19 (20)	31 (60)
Vatukoula Mine	356.3	Average	03 (19)	09 (11)	14 (70)
Rarawai Mill, Ba	551.0	Above Average	02 (11)	09 (12)	18 (77)
Yasawa-I-Rara	-	-	-	-	-
Viwa Is.	211.4	Below Average	03 (18)	11 (41)	18 (41)
Lautoka Mill(Research)	313.7	Average	05 (24)	09 (17)	22 (59)
Nadi Airport	339.0	Average	03 (11)	10 (27)	13 (62)
Nacocolevu, Sigatoka	379.6	Average	05 (25)	06 (14)	27 (61)
Tokotoko, Navua	845.3	Average	12 (22)	20 (27)	24 (51)
Laucala Bay, Suva	581.1	Average	13 (29)	21 (14)	26 (57)
Nausori Airport	525.2	Below Average	13 (25)	18 (17)	31 (58)
Nabouwalu	659.6	Above Average	11 (10)	24 (43)	19 (47)
Labasa Airport	337.3	Below Average	09 (12)	10 (34)	23 (54)
Savusavu Airport	431.1	Below Average	08 (23)	14 (37)	25 (40)
Udu Point	511.9	Below Average	11 (17)	18 (20)	25 (63)
Matei Airport	613.0	Average	09 (06)	14 (13)	27 (81)
Lakeba Is.	335.3	Average	06 (16)	06 (21)	14 (63)
Matuku Is.	-	-	-	-	-
Ono-I-Lau Is.	168.6	Below Average	03 (24)	08 (58)	06 (18)
Vunisea, Kadavu	384.7	Average	09 (33)	11 (15)	19 (52)
Rotuma	803.9	Below Average	16 (27)	23 (37)	22 (36)

Rainfall in the last three months

Rainfall in December

Most of the country received average or above average rainfall except Viwa, Labasa & Savusavu Airports and Ono-I-Laul. In the Western Division rainfall ranged below average to above average (60-188%), below average to above average was recorded in the Northern Division (66-166%), well below average to average in the Eastern Division (23-117%) and average to above average in the Central Division (114-146%).

Rainfall in the 3-months from October to December

The Rainfall forecast for the period October to December in the September Fiji Islands Weather Summary was for rainfall vary around average with most of the rainfall expected in the later part of the Oct-Dec period. The confidence level of the forecast was moderate.

Of the twenty sites that reported in time for this summary, seven sites reported below average, eleven sites average and two sites above average rainfall.

The rainfall deficiency as a result of the prolonged dry spell in 2003 continues to exist in parts of the Western, Northern and Eastern Division however conditions have eased especially in the last month.

Figure A

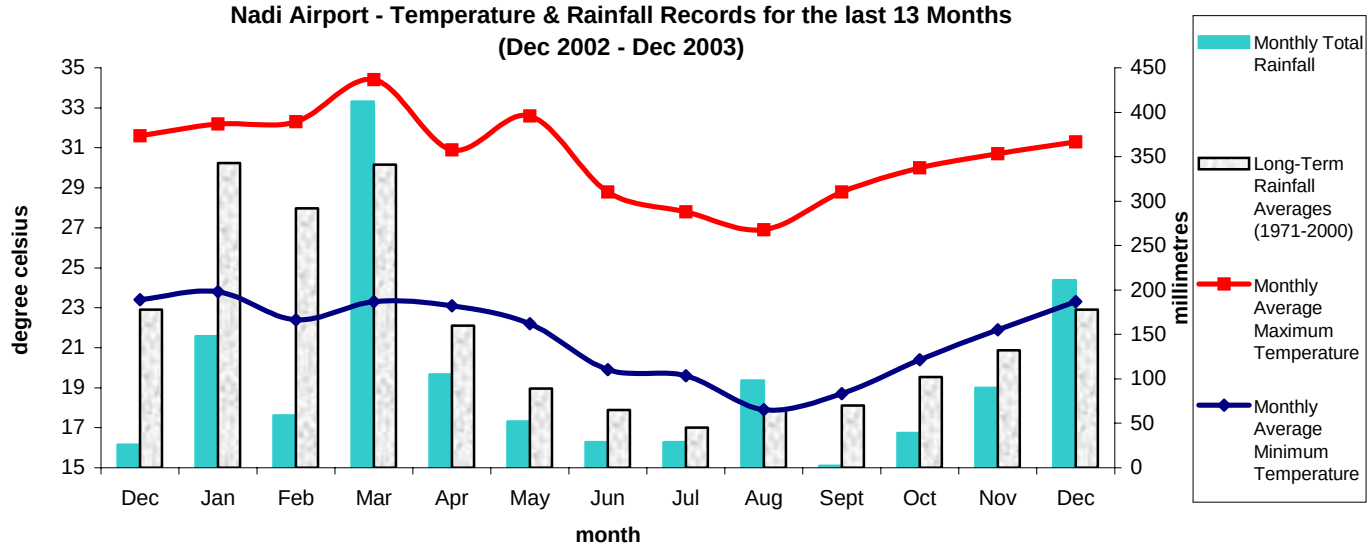


Figure B

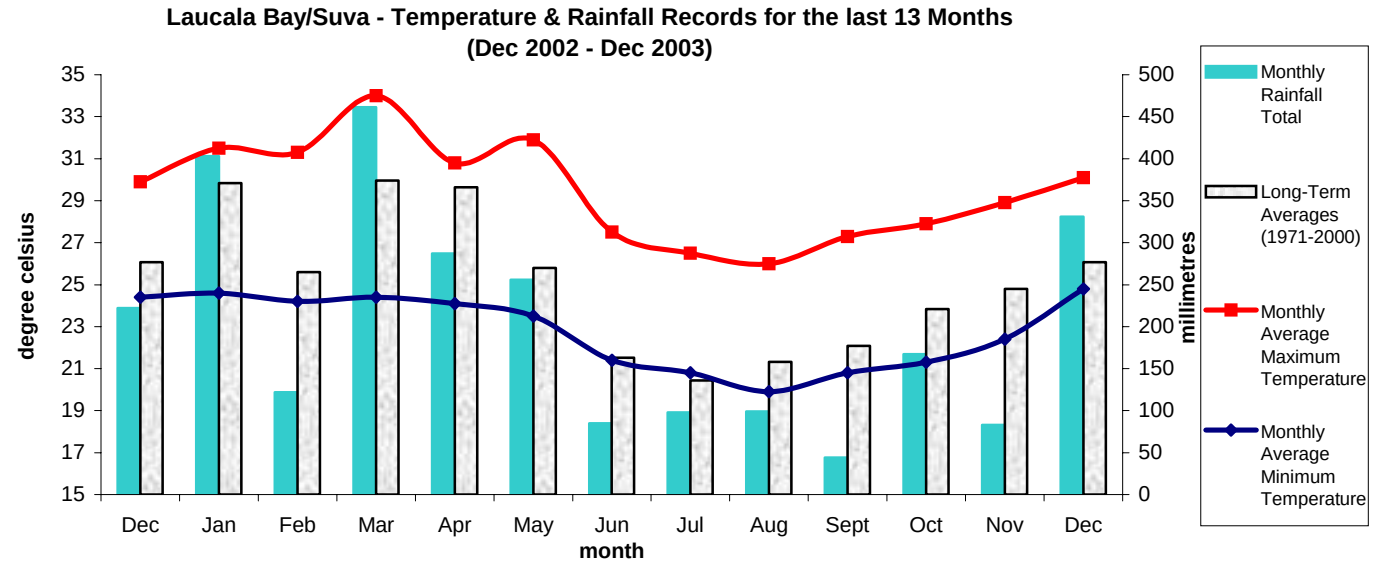
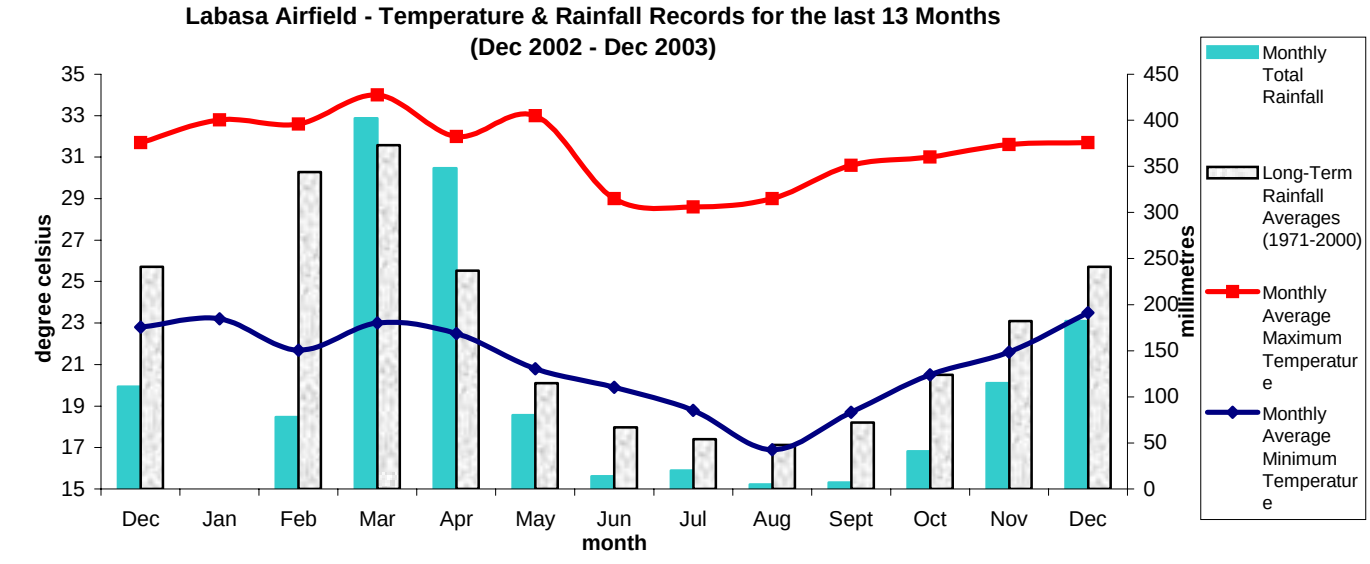


Figure C



Climate in December

Mean Day-time and Night-time Air Temperatures and Relative Humidity at 0900hrs.

Day-time temperatures varied around average across the country. The greatest positive departures were recorded at Nacocolevu and Viwa which recorded 0.8 and 0.6°C respectively above normal. The greatest negative departures were recorded at Vunisea and Savusavu Airport which recorded 0.8 and 0.7°C below normal.

Night-time temperatures were mainly average to above average. The greatest positive departures from normal were recorded at Labasa Airfield and Vatukoula which both recorded 1.8°C respectively above normal. The only negative departure from normal was at Udu Point which recorded 0.3°C respectively below normal.

Relative Humidity (RH) at 0900hrs varied around average. The greatest positive departure was +7% observed at Ono-I-Lau and Vunisea. The greatest negative departures were recorded at Rarawai Mill - 4%, Penang Mill - 3%.

Soil Moisture and Runoffs

Soil moisture conditions varied considerably throughout the month and across the country.

In the Western and Eastern Divisions conditions ranged from limiting to dry to excessive to ample at different locations and at various times during the month.

In the Central Division conditions were excessive to ample throughout the month.

In the Northern Division (including Matei) conditions were excessive to ample during the first half of the month at Savusavu, Nabouwalu and Matei. Conditions were limiting to dry at Labasa. In the second half of the month conditions were excessive to ample at across the whole of the Northern Division except for Savusavu during the last three days when conditions were moderate.

Rotuma recorded excessive to ample conditions throughout the month except from the 18-22nd when conditions were moderate.

Significant runoffs were recorded at Monasavu (690.0mm), Matei (329.7mm), Navua (284.4mm) and Rarawai (209.3mm).

Sunshine, Radiation & Winds

Total sunshine hours were around below average to average. Nadi Airport recorded 81%, Laucala Bay/Suva, 79%, Nacocolevu 95% and Rotuma 77% of normal.

Global Solar Radiation (average per day) recorded at Nadi Airport was 17.9MJ/ M^2 and 17.2MJ/M^2 at Laucala Bay.

Wind speed were above average at Nausori Airport and Lakeba, average at Vunisea and below average at Rotuma and Nadi Airport.

Records set in December 2003

Element	Station	Observed (record)	On	Rank	Previous (record)	Year	Records Began
Min Temp	Tokotoko, Navua	26.0	27th	New High	25.7	1996	1992
Min Temp	Viwa	27.2	12th	Equal High		1987	1978

November to April 2003/04 Tropical Cyclone Season

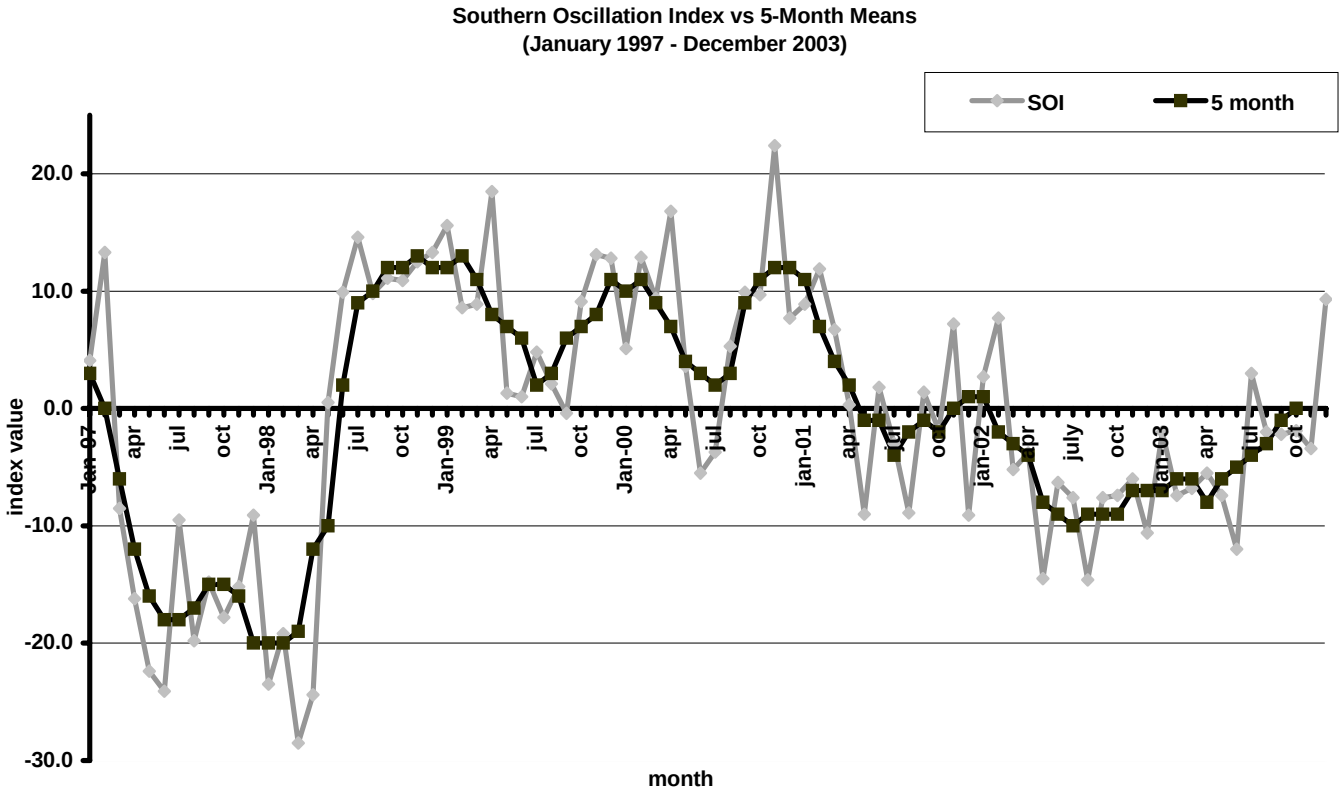
The South Pacific Tropical Cyclone Season officially began on 1st November and will continue till 30th April 2004.

The chances of cyclone activity in the Fiji region this season are slightly higher than normal based on the prediction that *Neutral* conditions will continue through the season. The average number of cyclones that have affected Fiji (including pre-season events) since 1969/70 is between 1 and 2. However, there have been as many as six events such as in 1996/97.

Historical records of tropical cyclones affecting Fiji since the 1969/70 show that fourteen cyclones have affected Fiji in January with four of them causing severe damage. The years were 1970, 75, 78, 80, 81 (2 events), 82, 85 (2 events), 97, 98, 2000 (2 events) and 2003.

Prior to and during a cyclone information on the event and regular updates will be provided on the Fiji Met Service *http://www.met.gov.fj* website, via *Poll fax* and the media.

Figure D



ENSO status and Rainfall Outlook to March 2004

The Southern Oscillation Index (SOI) for December was 9.8 (November was -3.4) with the five-month running mean of 0 centred on October (September was -1) (Figure D).

Overall, indicators suggest neutral-ENSO conditions are persisting. The SOI has been stable near zero for several months, though the late-December passage of a tropical cyclone just east of Darwin has resulted in a recent rise. Warm SSTs dominate the tropical Pacific Ocean and the standard SST indices of Nino 3 and 4 are warmer than normal. It should be noted though the near equatorial cool tongue remains well defined in the far east, and the warm pool is centred west of the dateline, a pattern consistent with neutral ENSO conditions.

Several ENSO model predictions from December 2003, which span the southern hemisphere autumn, indicate the continuation of neutral conditions, while some indicate the development of warm conditions. It should be noted though that historically models have little skill over this period.
(The ENSO Update and SOI are provided by of the National Climate Centre, Australian Bureau of Meteorology and can be found at http://www.bom.gov.au)

FMS Rainfall Prediction Model: *This model is based on schemes, which have run successfully at the Australian Bureau of Meteorology's National Climate Centre. These a statistical scheme based on the relationship between SOI and subsequent three-month rainfall totals. In each case the probability of low, medium or high rainfall in the oncoming three-month period is provided. The scheme uses the SOI averaged over the most recent three-month period. The reliability of the model is high during the wet season (Nov-Mar) but decreases during the dry season (May-Sept) and during the transitions months, April and October.*

Below average rainfall is predicted for the Western Division, western half of the Northern Division and parts of the Eastern Division. Other areas are predicted to received below average to average rainfall (Figure E).

Australian Rainman: *This is a Rainfall Prediction Model was created from joint efforts between Australia Meteorological and Agricultural Agencies. The model incorporates the use of SOI to test its effects on the probability of rainfall in upcoming months. It shows the relationship between ENSO (El Niño - Southern Oscillation) events and rainfall. Due to public demand this model is currently used to present the probability of receiving rainfall in the coming individual months over a three-month period. Please note that the reliability of forecast for one month is lower than for a combined three month period.*

The model predicts a 34-69% chance (depending on location) of receiving average rainfall across Fiji in next three months (Table. 2).

Outlook for January to March 2004:

Based on the model predictions and 'neutral' conditions, Fiji's rainfall is expected to vary around average in the next three months.

NOTE: The confidence level in the outlook is 'moderate'.

Preliminary Climatological Summary for December 2004

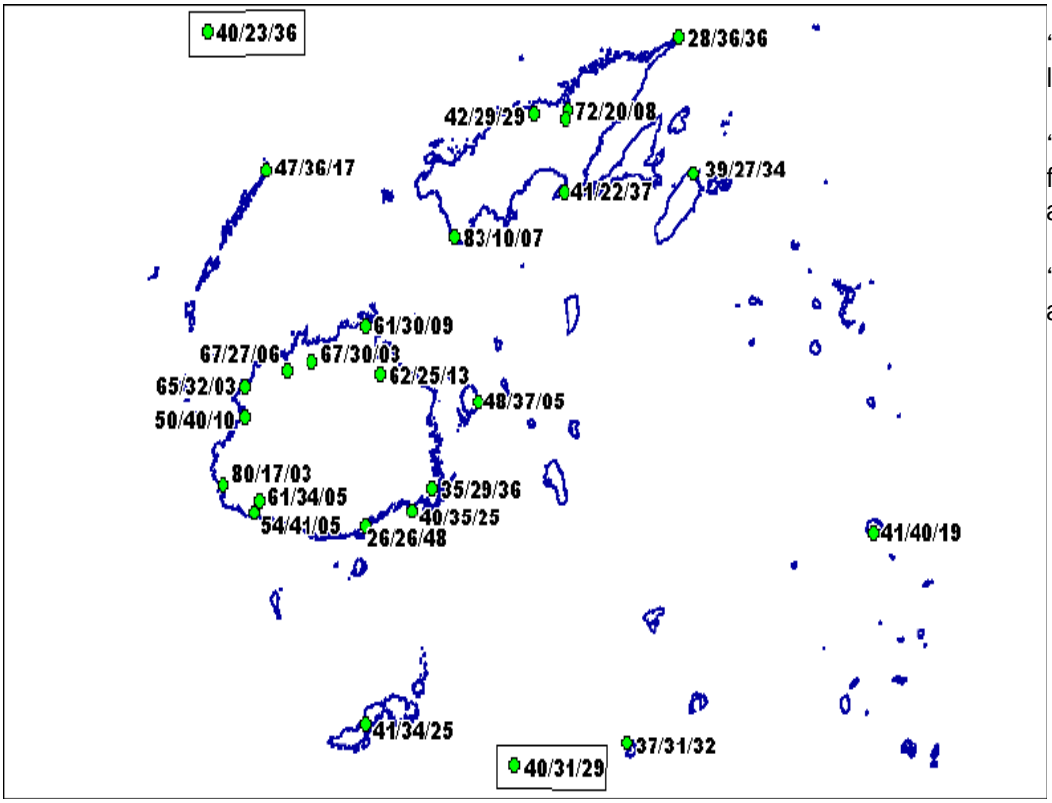
	RAINFALL					AIR TEMPERATURES								SUNSHINE	
	TOTAL		RAIN	MAX.		AVERAGE DAILY				EXTREME				TOTAL	
		*	DAYS	FALL		MAX.	#	MIN.	#	MAX.		MIN.			*
	MM	%	+	MM	ON	C	C	C	C	C	ON	C	ON	HRS	%
NADI AIRPORT	211	118	22	40	5	31.3	-0.2	23.3	0.9	34.4	1	20.9	9	184	81
SUVA/LAUCALA BAY	331	146	24	70	17	30.1	-0.2	24.8	1.3	31.9	21	22.8	6	155	79
NACOCOLEVU	229	121	13	50	17	31.7	0.8	22.6	1.0	33.5	29	20.5	9	169	92
ROTUMA	287	101	22	77	6	31.2	0.5	24.9	0.2	33.0	4	22.0	5	139	77
VIWA	86	60	10	31	28	31.5	0.6	25.4	0.4	33.0	27	16.8	17		
UDU POINT	322	122	25	74	19	30.2	-0.3	24.0	-0.2	31.5	22	21.9	1		
LABASA AIRFIELD	182	76	19	38	26	31.7	0.0	23.5	1.8	33.4	17	20.9	10		
NABOUWALU	314	123	31	73	5	29.8	0.2	25.0	1.0	31.0	17	23.3	5		
SAVUSAVU AIRFIELD	171	66	23	25	1	29.5	-0.7	24.7	1.6	32.0	25	23.4	3		
MATEI AIRFIELD	500	166	27	97	24	29.6	0.0	23.8	0.0	31.3	19	22.2	3		
*YASAWA-I-RARA	Faulty AWS														
VATUKOULA	245	103	13	103	23	32.4	0.3	23.1	1.7	34.7	15	20.3	8		
MONASAVU	792	147	30	104	4	24.6	-0.3	19.7	1.3	27.4	16	18.0	6		
NAUSORI AIRPORT	304	114	26	50	17	29.6	-0.1	23.6	1.0	30.8	25	20.5	26		
NAVUA/TOKOTOKO	435	116	27	94	21	29.1	-0.4	23.9	1.1	30.5	25	22.0	5		
LAKEBA	210	117	14	63	4	29.8	0.1	24.7	1.0	31.1	30	21.4	3		
*MATUKU	Faulty AWS														
VUNISEA	199	104	19	61	5	28.6	-0.8	23.9	1.0	29.9	24	22.1	19		
ONO-I-LAU	31	23	6	9	18	28.7	-0.0	23.8	0.3	31.2	28	20.9	24		
BA/RARAWAI MILL	424	188	18	134	23	32.7	0.4	22.4	0.7	35.0	11	17.8	9		
LAUTOKA AES	185	96	17	34	6	31.1	0.1	23.7	0.4	34.5	1	21.2	9		
PENANG MILL	297	112	20	80	23	30.7	0.4	23.6	0.1	32.0	20	21.6	4		

	PE	WATER BALANCE(MM)						TEMPERATURE(C)			HUMIDITY		WIND	SUN	RAD
		MAX.		LAST	DEF	NO	RO	NO	DLY	DRY	WET	RH%	VP		%OF	MJ/
	.1MM	DS	ON	DS		DYS		DYS	MEAN	(AVERAGE | AT 9AM)			KT	POS	SQ.M
NADI AIRPORT	54	45	2	22	0	0	27	4	27.3	28.9	25.0	72	28.6	4.4	47	17.9
SUVA/LAUCALA BAY	50	19	31	19	0	0	180	9	27.4	27.5	25.2	83	30.4		41	17.2
NACOCOLEVU	51	75	11	31	1	1	46	2	27.1	28.3	25.6	80	30.8		44	20
ROTUMA	52	36	20	21	0	0	137	7	28.1	28.8	26.2	81	32.1	2.3	39	19
VIWA	56	75	1	65	97	20	0	0	28.5	28.8	25.7	78	30.7			
UDU POINT	50	35	1	16	0	0	129	4	27.1	28.0	25.6	83	31.1			
LABASA AIRFIELD	52	75	4	41	7	3	0	0	27.6	28.9	25.0	72	28.7			
NABOUWALU	51	42	18	5	0	0	146	11	27.4	27.8	25.3	81	30.2	11.5		
SAVUSAVU AIRFIELD	49	35	31	35	0	0	18	5	27.1	27.5	25.3	83	30.5			
MATEI AIRFIELD	50	20	9	4	0	0	330	17	26.7	27.5	25.3	83	30.5			
*YASAWA-I-RARA	Faulty AWS															
VATUKOULA	54	75	1	42	59	13	104	2	27.8	29.5	24.2	64	26.1			
MONASAVU	38	6	31	6	0	0	672	21	22.2	21.7	20.7	91	23.6			
NAUSORI AIRPORT	48	24	11	17	0	0	158	8	26.6	27.5	25.0	81	29.7	6.5		
NAVUA/TOKOTOKO	48	20	16	8	0	0	284	13	26.5	27.0	24.9	84	29.9			
LAKEBA	50	46	17	38	0	0	78	4	27.2	28.1	25.3	79	30.0	10.8		
*MATUKU	Faulty AWS															
VUNISEA	50	50	31	50	0	0	84	4	26.3	26.8	24.7	83	29.4	9.8		
ONO-I-LAU	50	75	1	75	124	27	0	0	26.2	26.2	24.0	83	28.2			
BA/RARAWAI MILL	54	60	12	7	0	0	209	3	27.6	29.3	24.7	68	27.5			
LAUTOKA AES	54	45	29	34	0	0	16	3	27.4	28.7	24.8	72	28.3			
PENANG MILL	54	55	22	26	0	0	139	5	27.1	27.3	24.8	81	29.4			

DS IS SOIL MOISTURE DEFICIT,LIMIT 75 MM; RO IS WATER SURPLUS (INDEX OF RUNOFF)
DEF (AE-PE) IS EVAPOTRANSPIRATION DEFICIT (INDEX OF IRRIGATION WATER NEEDED.
PE IS LONG TERM MEAN PENMAN POTENTIAL EVAPOTRANSPIRATION (CALCULATED OR ESTIMATED).
MEAN TEMPERATURE IS (MAX+MIN)/2; WIND IS MEAN SPEED AT 06,12,18,24 HOURS.
$:SOLAR RADIATION CALCULATED FROM SUNSHINE DURATION. # :DEPARTURE FROM NORMAL.
+ :NUMBER OF DAYS WITH 0.1 MM OR MORE RAIN. * :PERCENT OF NORMAL.

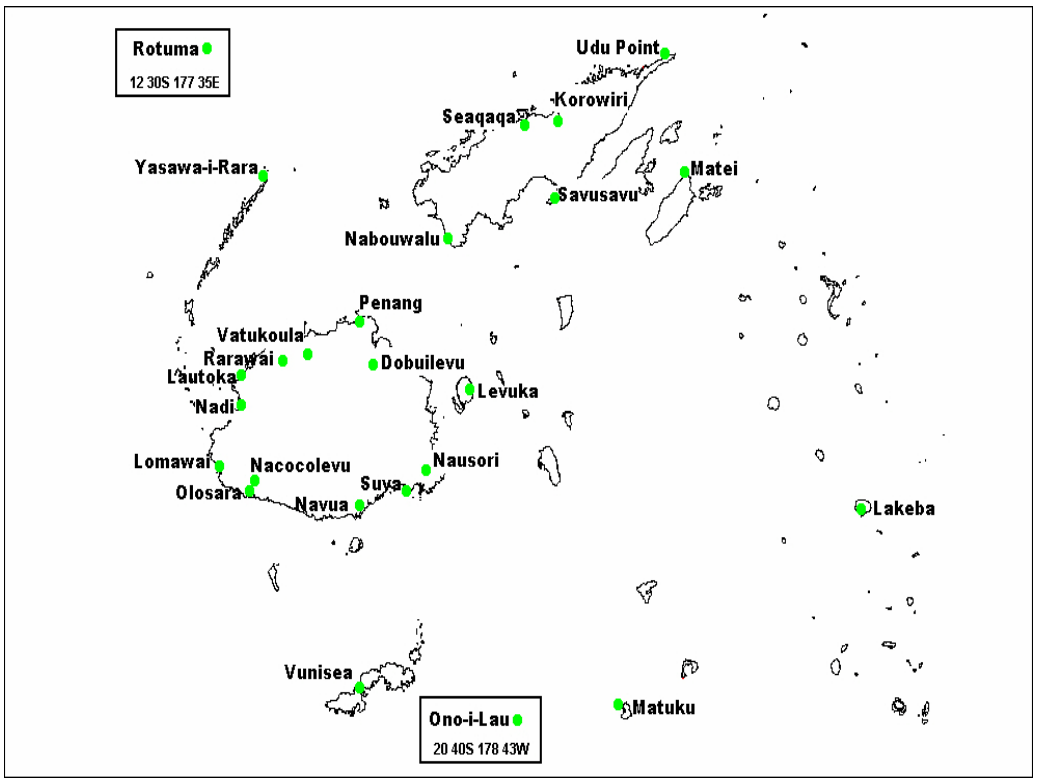
Three Month Rainfall Outlook Probabilities for January to March 2004

FIGURE E*:* Three Month Forecast for Selected Stations in Fiji using the Fiji Meteorological Services Rainfall Prediction Model



Please note that the probabilities are listed beside of the corresponding station marker or dot.

FIGURE F*:* Reference Map of selected Climate/Rainfall sites in Fiji



The forecast probabilities are presented as

DRY/NORMAL/WET

'DRY' range refers to rainfall less than 33rd percentile.

'NORMAL' (average) range refers to rainfall between 33rd and 67th percentiles.

'WET' range refers to rainfall above 67th percentile.

Reference Table for 33rd and 67th Percentile

Station	33% (mm)	67% (mm)
Western Division		
Dobuilevu	987	1227
Vatukoula	907	1418
Rarawai	937	1282
Penang	928	1182
Lautoka	810	1063
Nadi	819	1068
Lomawai	692	1020
Nacocolevu	666	908
Olosara	618	830
Yasawa	697	933
Central Division		
Navua	944	1247
Suva	866	1109
Nausori	893	1067
Eastern Division		
Levuka	721	958
Lakeba	631	851
Matuku	586	773
Ono-I-Lau	512	690
Vunisea	623	834
Northern Division		
Labasa Mill	919	1257
Seaqaqa	1041	1378
Nabouwalu	841	1088
Savusavu	675	869
Udu Point	797	1017
Matei	852	1109
Rotuma	941	1185

TABLE 3: Monthly Rainfall Outlook Probabilities for January to March 2004

	January 2004		February 2004		March 2004		Jan to Mar 2004 combined	
Station Name	**Average***	**Probability#**	**Average***	**Probability#**	**Average***	**Probability#**	**Average***	**Probability#**
Western Division								
Dobuilevu	393	**57**	334	**38**	429	**41**	1156	**37**
Vatukoula	398	**43**	386	**51**	382	**23**	1166	**43**
Rarawai	402	**42**	347	**37**	365	**53**	1114	**51**
Penang	396	**43**	336	**37**	425	**45**	1157	**40**
Lautoka	371	**50**	301	**33**	308	**46**	980	**54**
Nadi	343	**57**	292	**27**	341	**32**	976	**48**
Lomawai	337	**31**	250	**21**	294	**52**	881	**34**
Olosara	283	**43**	215	**49**	258	**36**	756	**52**
Nacocolevu	276	**43**	234	**42**	275	**43**	785	**60**
Yasawa-I-Rara	235	**56**	240	**40**	276	**27**	751	**49**
Central Division								
Navua - Tamanoa	395	**42**	283	**39**	413	**59**	1091	**57**
Suva	371	**48**	265	**54**	374	**45**	1010	**58**
Nausori	365	**45**	268	**46**	382	**46**	1015	**64**
Eastern Division								
Lakeba	245	**66**	226	**22**	293	**27**	764	**62**
Ono-I-Lau	179	**48**	194	**54**	253	**20**	626	**46**
Northern Division								
Korowiri	395	**39**	365	**48**	378	**28**	1138	**42**
Seaqaqa	419	**48**	389	**35**	392	**15**	1200	**35**
Nabouwalu	312	**63**	276	**68**	335	**48**	923	**53**
Savusavu	275	**51**	244	**46**	283	**33**	802	**50**
Udu Point	313	**62**	249	**35**	320	**30**	882	**47**
Rotuma	355	**37**	322	**55**	369	**42**	1046	**69**

Please note that the above figures should be used with caution, as there is some degree of uncertainty associated with them, and particularly the reliability of the model is low during the transition months and the dry season.

The probabilities in the three-month combined column are not an average of the three individual months. The model in this case has been re-run for three combined months. There is a higher degree of skill association with predicting rainfall for three combined months compared to three individual months.

** 'Long-term Average' for the 30 year period from 1971-2000.*
 # Probability of expecting at least normal rainfall.