



# 2023 ANNUAL CLIMATE SUMMARY

FIJI METEOROLOGICAL SERVICE



**MPWTMS**  
MINISTRY OF  
PUBLIC WORKS, TRANSPORT  
& METEOROLOGICAL SERVICES

# Highlights



Severe tropical cyclone Mal was the only TC that had a significant impact on Fiji during 2023. Mal brought gale force winds, torrential heavy rain, which led to severe flooding of Fiji's major rivers and low-lying areas, damaged weakly structured properties, infrastructures and livestock.



The national average mean air temperature for Fiji in 2023 was the 8<sup>th</sup> warmest on record since 1959. The national average mean, maximum and minimum air temperatures between 1959 and 2023 have increased by 1.0°C, 1.1°C and 0.9°C, respectively.



Fiji's national average rainfall for 2023 was 2190mm, which was 97% of the long-term average. Fiji's rainfall continue to display large year-to-year variability associated with the El Niño and La Niña events. Extreme rainfall events were recorded, including rainfall associated with Severe TC Judy, Tropical Depressions and active troughs of low pressure in other months.



Global mean sea level continue to rise in 2023 (WMO- 2023 State of Climate report).  
For Fiji, sea-level rise around the country measured by satellite altimeters from 1992 to 2023 was between 4-5mm/yr. A state of the art sea level monitoring station at the Lautoka Wharf had a relative sea level trend of 4.3mm/yr. The mean annual sea surface temperatures to the northeast of Fiji's EEZ were warmest on record in 2023.

# Large Scale Climate Drivers

## El Niño Southern Oscillation (ENSO)

El Niño Southern Oscillation (ENSO) strongly influences Fiji's year-to-year climate variability, with the two ENSO phenomenon extremes known as El Niño and La Niña. Although an establishment of an ENSO extreme event is observed within the tropical Pacific region, its impacts can be observed globally. However, impacts associated with the two ENSO extreme events differ for various countries. An establishment of El Niño, is often associated with sustained warming over a large part of the central and eastern equatorial Pacific Ocean, accompanied by persistent negative values of Southern Oscillation Index (SOI), a decrease in the strength or reversal of the Trade winds and increase in cloudiness near the Dateline.

During La Niña, there is sustained cooling of the central and eastern equatorial Pacific Ocean, accompanied by persistent positive values of SOI, an increase in strength of the

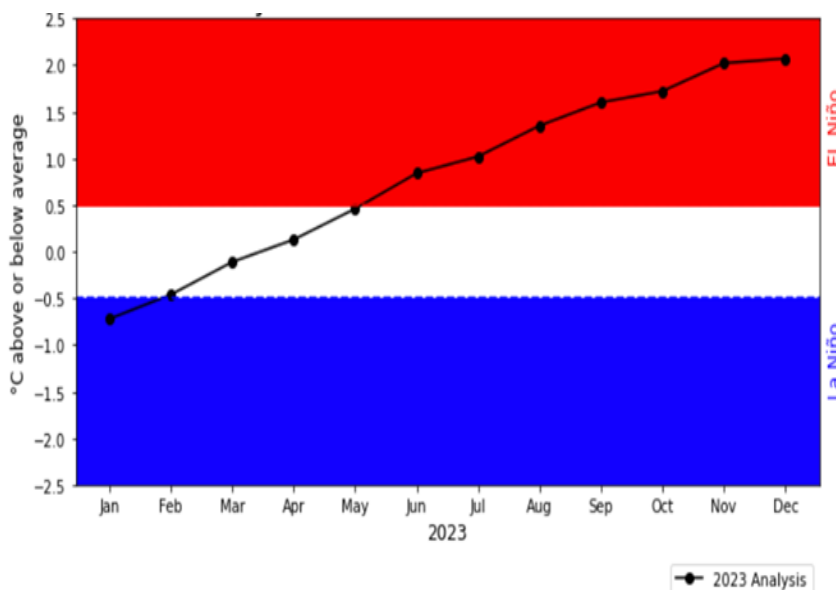


Figure 1: Monthly NINO3.4 anomalies indicate that the Pacific Ocean was leaning towards a weak La Niña during January to February, following a transition to ENSO-neutral phase from March to June, and thereafter El Niño conditions prevailed for the rest of 2023. Data source: NOAA

equatorial trade winds and decrease in cloudiness near the Dateline. While no two El Niño and La Niña events behave in exactly the same manner, they tend to have some general impacts on Fiji's climate. El Niño events often lead to drier than usual condition over Fiji, which can result in drought events. On the other hand, La Niña events have been associated with more rainfall than usual, which

# Large Scale Climate Drivers (Cont.)

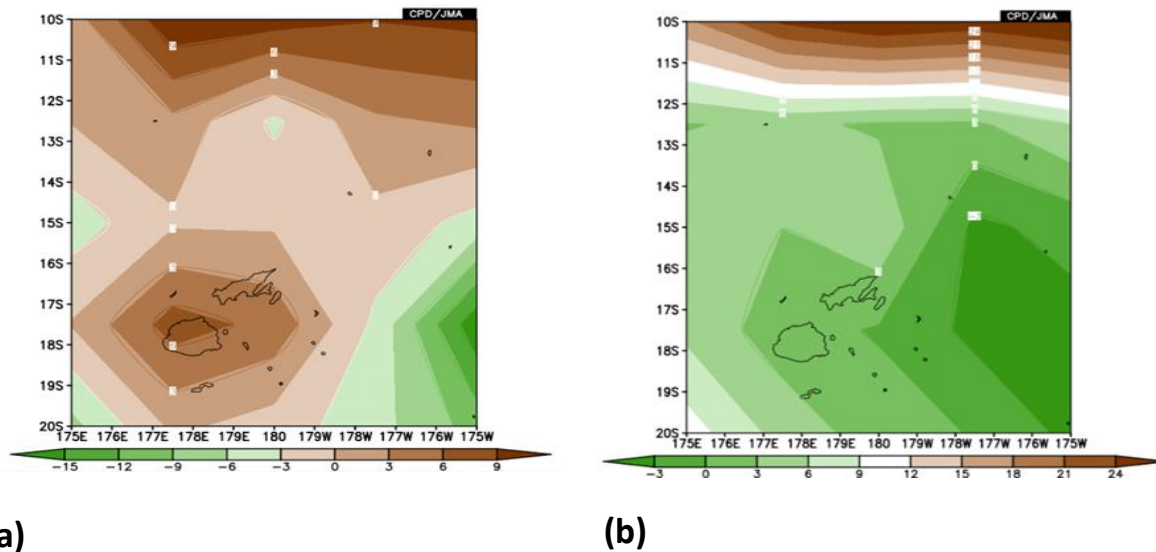
can lead to floods, especially during the Wet Season, from November to April.

The tropical Pacific was in a weak La Niña state during January to February 2023. The triple-deep La Niña which started in 2020, concluded towards end of February 2023. ENSO-neutral state prevailed from March to June. During July 2023, most of the oceanic and atmospheric indicators were leaning towards a weak El Niño event, and this pattern continued till September. From October onwards, the event intensified to a moderate to strong El Niño.

Cooler than usual sea surface temperatures were concentrated in the central and eastern equatorial Pacific, while warm anomalies were present far west of the Pacific during January to February. During March, ENSO became neutral (neither La Niña nor El Niño) with oceanic and atmospheric indicators returning to neutral ENSO levels. ENSO-neutral conditions prevailed till June, with sea surface temperatures in the central and eastern Pacific warming to El Niño thresholds. In July, most oceanic and atmospheric indicators were leaning towards a weak El Niño event. The weak El Niño event continued till September.

During October, warmer than average sea surface temperatures continued to persist above El Niño thresholds across the tropical Pacific Ocean, with warmer waters beneath the surface to support further surface warming. The warming continued till December, and there was a clear coupling response from the atmosphere, which indicated establishment of a moderate to strong El Niño event in the tropical Pacific.

# Large Scale Climate Drivers (Cont.)



*Figure 2: Outgoing longwave (OLR) radiation anomalies for (a) March to May; (b) June to September 2023. Suppressed cloud cover (positive OLR anomalies) persisted over the Fiji Group during March to May 2023, while enhanced cloud cover (negative OLR anomalies) was present across the Fiji Group during June to September 2023. Image source: Japan Meteorological Agency.*

Fiji's weather at the beginning of the year displayed weak La Niña pattern, with the South Pacific Convergence Zone displaced south of its normal position closer to the Fiji Group. Consequently, most parts of the country were wetter than usual in the first two months. Rainfall was quite suppressed during March to May, as most places experienced drier than normal conditions. On the other hand, wetter than normal conditions prevailed across the Fiji Group from June to September. As El Niño intensified towards the end of 2023, Fiji's rainfall pattern became typical of an El Niño event, especially during the last three months of the year as drier than normal conditions were experienced.

# Large Scale Climate Drivers (Cont.)

## Madden Julian Oscillation (MJO)

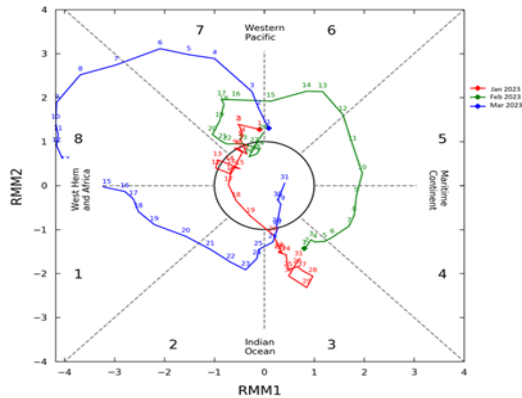
The Madden Julian Oscillation is an eastward moving pulse of rainfall and cloudiness in the tropical Pacific, which usually begins in the Indian Ocean and then makes its way around the globe with a periodicity of 20-90 days. When the active phase of MJO is in the western Pacific then there is usually a surge in the convective activity in the southwest Pacific. The South Pacific Convergence Zone becomes more active, with formation of a number of low pressure systems, tropical disturbances, tropical depressions and tropical cyclones within a period of two to three weeks in the region around Fiji.

During 2023, six active MJO pulses passed through the western Pacific. The strongest of these pulses were in January, February, March, April and May (Figure 3).

From January 1<sup>st</sup> to 9<sup>th</sup>, a strong MJO pulse was present in the western Pacific, which enhanced the monsoon impacts across the Australian region. A strong MJO pulse was active from February 12<sup>th</sup> to 28<sup>th</sup>. During this time, Severe TC Gabrielle and Severe TC Judy formed in the region. Gabrielle caused widespread flooding, landslides and huge ocean swells in New Zealand while Judy caused extensive damages over land and coastal communities in Vanuatu. From March 1<sup>st</sup> to 6<sup>th</sup>, MJO pulse was active in the western Pacific, and during this time Severe TC Kevin formed. Kevin affected Fiji in terms of heavy rain and strong northerly winds, causing flash floods across the Western Division. Two strong MJO pulses were active in the western Pacific from April 7<sup>th</sup> to 17<sup>th</sup> and from May 9<sup>th</sup> to 27<sup>th</sup>, but did not have any significant influence on Fiji's climate.

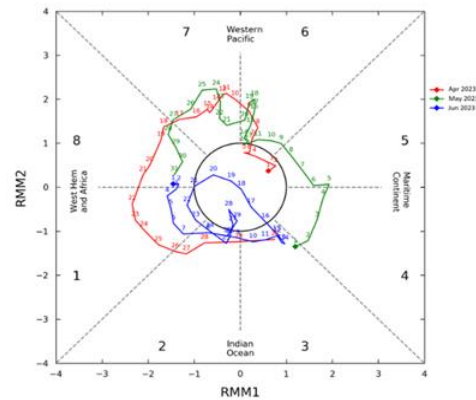
# Large Scale Climate Drivers (Cont.)

(RMM1, RMM2) phase space for 01-Jan-2023 to 31-Mar-2023



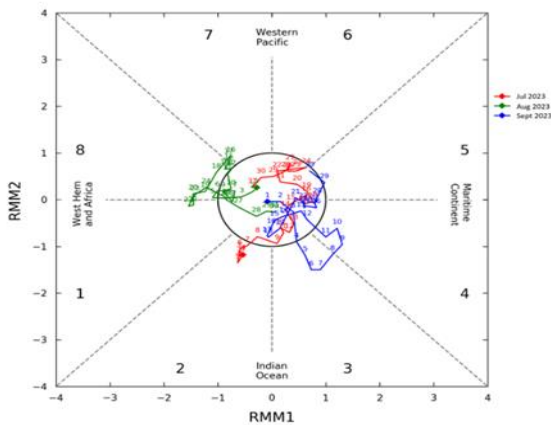
(a)

(RMM1, RMM2) phase space for 01-Apr-2023 to 30-Jun-2023



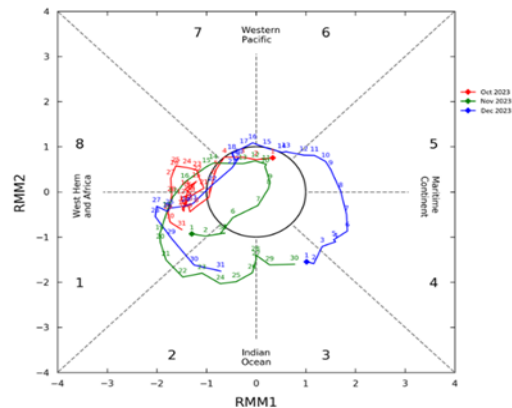
(b)

(RMM1, RMM2) phase space for 01-Jul-2023 to 30-Sep-2023



(c)

(RMM1, RMM2) phase space for 01-Oct-2023 to 31-Dec-2023

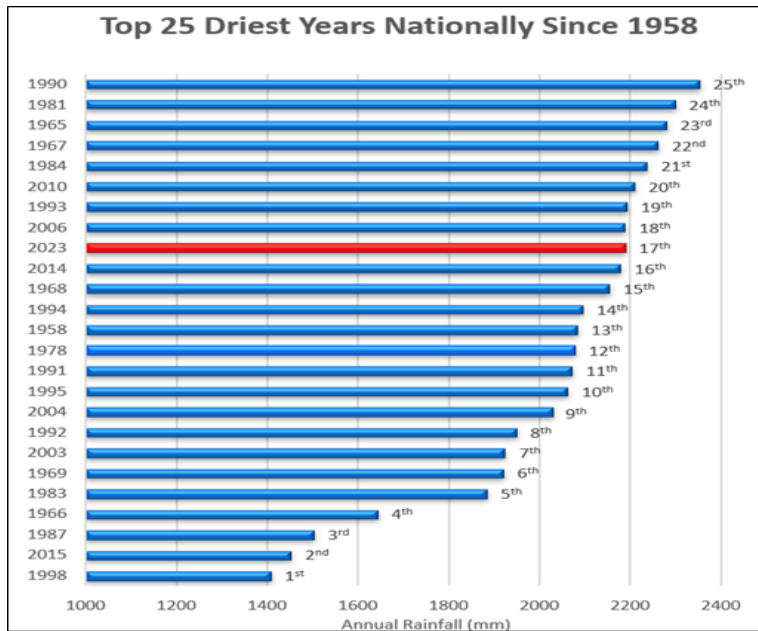


(d)

Figure 3: The MJO phase diagram illustrates the progression of the MJO through locations along the equator around the globe. When the index is within the centre circle, the MJO is considered weak. Outside of this circle the index is stronger and will usually move in an anti-clockwise direction as the MJO moves from west to east. Phases 6 and 7 are western Pacific. Data source: BoM.

# Rainfall

Fiji's national average rainfall for 2023 was 2190 mm, which was 97% of the long-term average. This ranks 2023 as the 17<sup>th</sup> driest year in 66 years of record (Figure 4).



Fiji's national annual average rainfall is not showing any significant increasing or decreasing trend between 1958 to 2023, with a large year-to-year variability associated with the El Niño and La Niña events (Figure 5). Similarly, the national average Wet (November to April) and Dry (May to October) Seasons also have no significant trends.

Figure 4: National average annual rainfall.

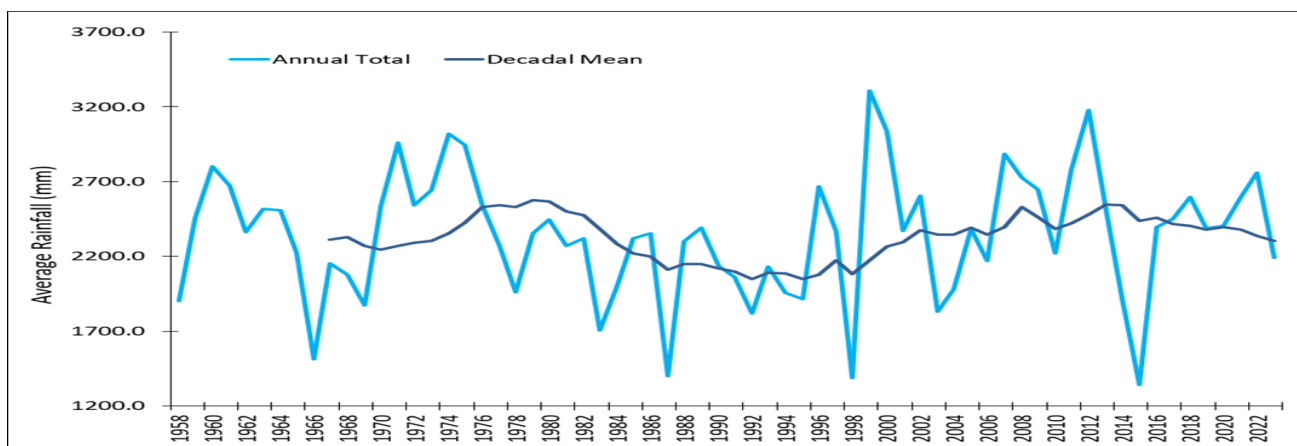


Figure 5: Time series of national average annual and decadal running mean rainfall from 1958 to 2023.



# Rainfall (Cont.)

The annual total rainfall in 2023 at individual rainfall monitoring stations was near normal or above normal at majority of the stations. Out of the 20 rainfall monitoring sites, 5 registered above normal rainfall, 14 normal, while Matei Airfield recorded below normal rainfall (Figure 6).

Rainfall was significantly wetter than usual in January and February. Rain bands associated with Tropical Depression 08F and Severe Tropical Cyclone Judy brought

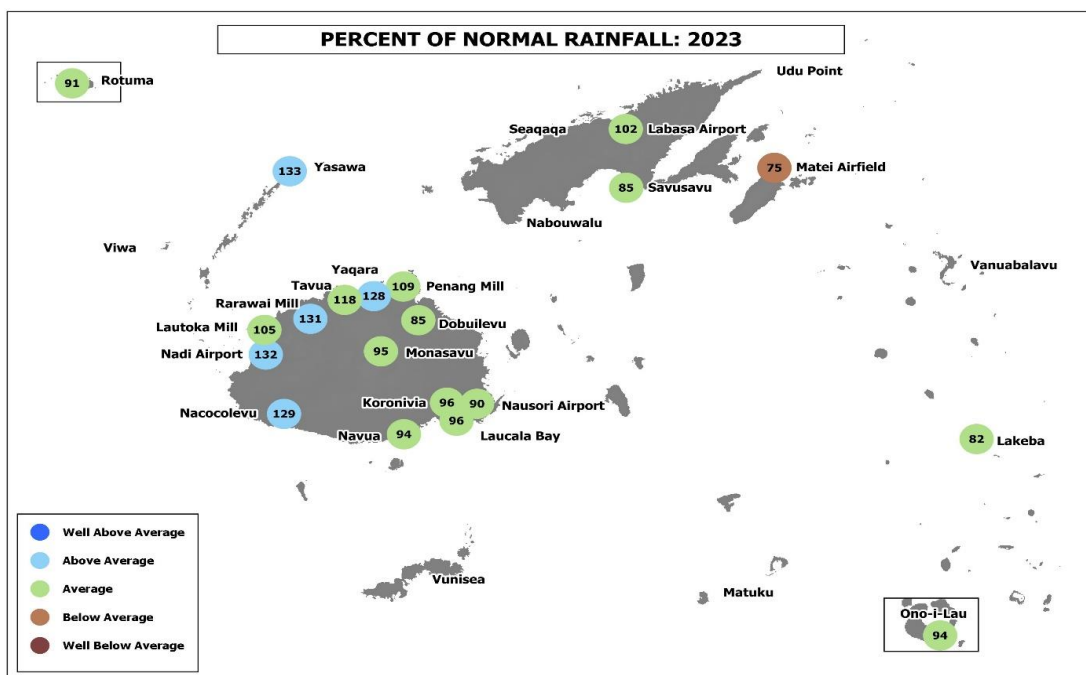


Figure 6: Percent of normal (1981 to 2010 mean) rainfall in 2023 at various rainfall monitoring stations across the country.

significant rainfall to various locations in February, with Nadarivatu recording 105mm on the 12<sup>th</sup>, followed by Lautoka with 105mm on the 14<sup>th</sup>, Nadarivatu with 126mm on the 15<sup>th</sup>, Tavua with 204mm, Yaqara with 192mm, Nadarivatu with 189mm, Lautoka Mill with 188mm, Momi with 179mm, Nadi Airport with 156mm, and Rarawai Mill (Ba) with 139mm, all on the 16<sup>th</sup>, and Penang Mill with 190mm on the 17<sup>th</sup>.

## Rainfall (Cont.)

On the other hand, April, October, November, and December were significantly drier than normal (Figure 7). During October, extended period of dry days were recorded across all the divisions. The Sigatoka to Penang corridor, Yasawa-i-Rara and Mamanuca Groups and Saqani, Vunisea, Labasa, and Vanuabalavu recorded less than five rain days during October.

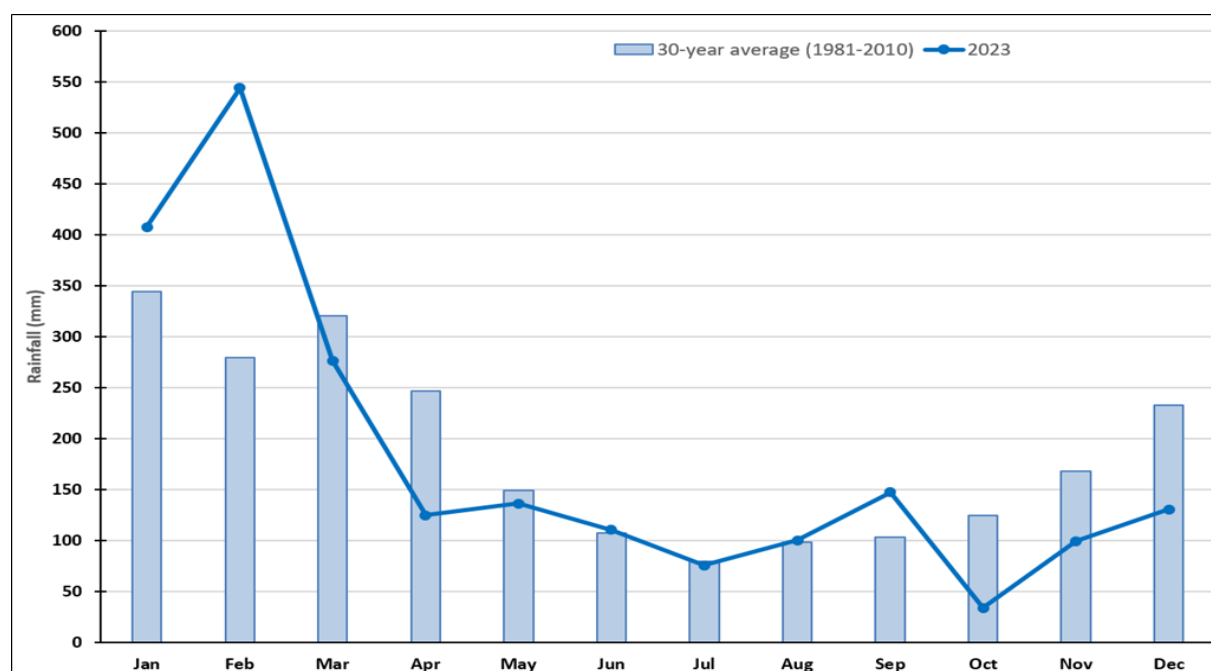


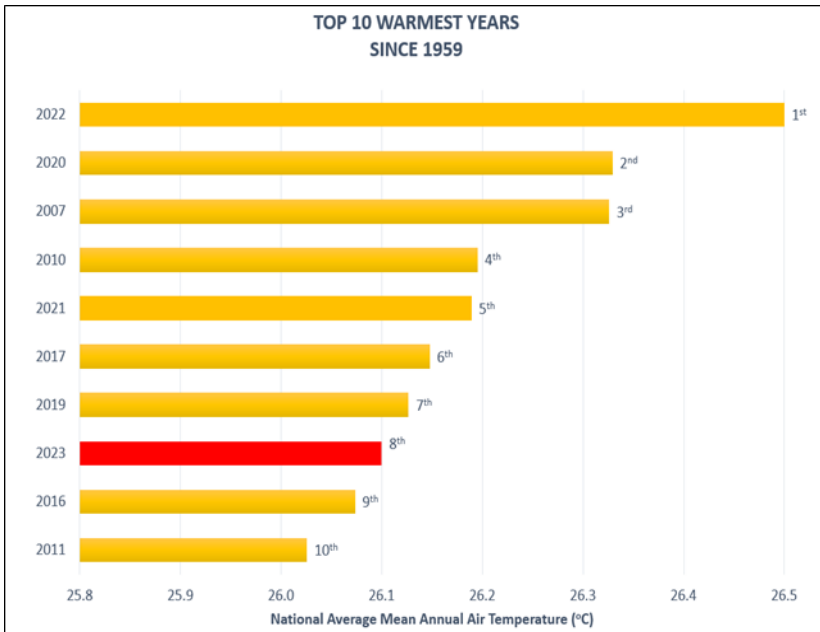
Figure 7: National average monthly rainfall during 2023 compared with the long-term average (1981-2010).

Overall, the wettest location during 2023 was Monasavu with 4660mm of the annual total rainfall, followed by Nadarivatu with 4125mm, Navua with 3246mm and Rotuma with 3216mm. On the other hand, Ono-i-Lau was the driest site with 1460mm of rainfall, followed by Lakeba with 1541mm, Savusavu with 1821mm and Matei with 1921mm.

# Air Temperatures

## Mean Air Temperature

The year 2023 was the 8<sup>th</sup> warmest year on record in Fiji with the national average mean air temperature of 26.1°C, which was 0.5°C warmer than the normal (Figure 8).



The most recent decade ending in 2020 was also warmest on record in Fiji. This pattern has continued with every new decade being warmer than all previous decades since 1960s (Figure 9).

Figure 8: Top 10 warmest national average mean air temperatures for Fiji.

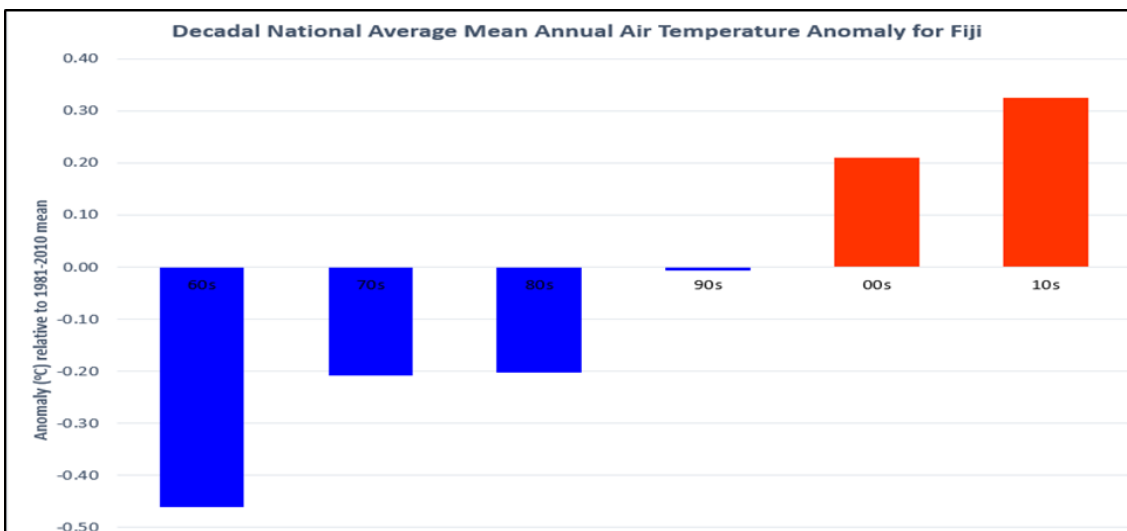


Figure 9: Decadal national average mean annual air temperature anomalies for Fiji.

# Air Temperatures (Cont.)

The national mean annual air temperature has increased by 1.0°C between 1959 and 2023 (statistically significant rise at 95% confidence level) (Figure 10). This trend is consistent with the global pattern of rising air temperatures as greenhouse gas concentration increases in the atmosphere.

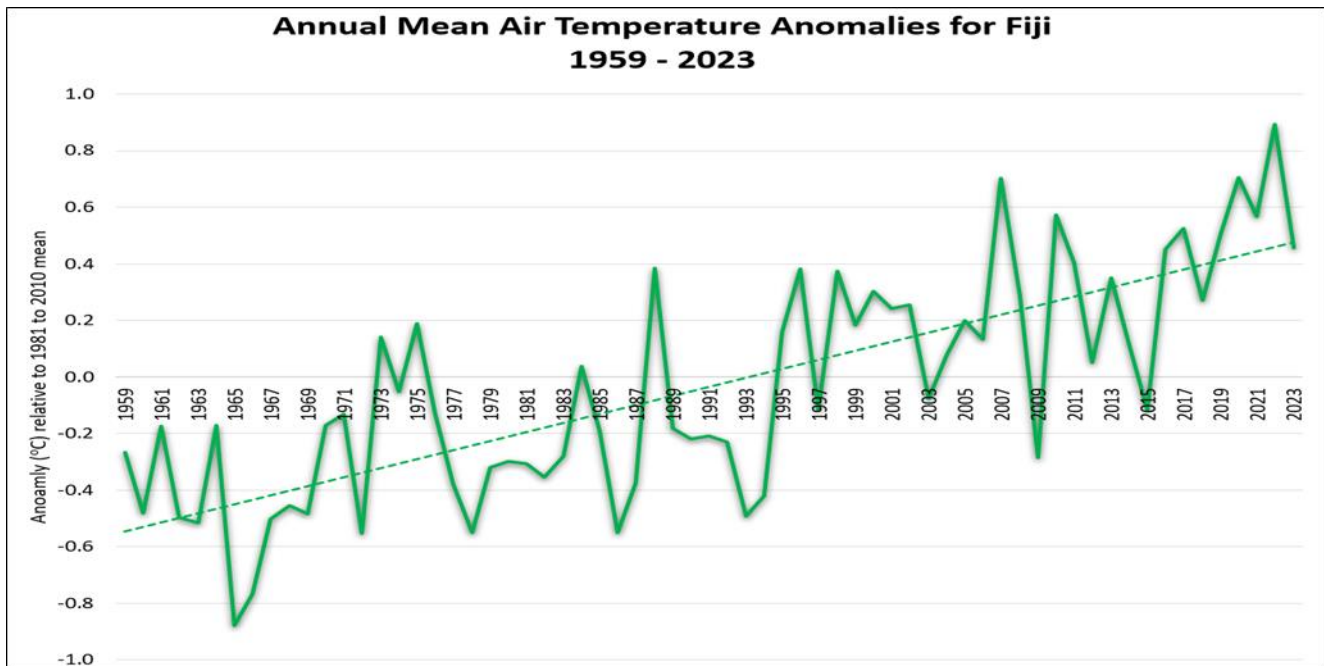


Figure 10: Time series of national average mean annual air temperature anomaly relative to 1981-2010 mean together with the associated trend.

## Maximum and Minimum Air Temperatures

The country's national average annual maximum air temperature during 2023 was 29.9°C, which was 0.7°C warmer than the normal. This categorizes it as the 2<sup>nd</sup> warmest national annual maximum air temperature since 1959. The year 2022 is warmest on record, followed by 2023 and 2021.

The national average annual minimum air temperature during 2023 was 22.2°C, which was 0.2°C warmer than the normal. This ranks as the 21<sup>st</sup> warmest annual minimum air temperature on record since 1959.

# Air Temperatures (Cont.)

The national average maximum air temperature has increased by 1.1°C between 1959 and 2023 (statistically significant rise at 95% confidence level). Similarly, the national average minimum air temperature has increased by 0.9°C between 1959 and 2023 (statistically significant rise at 95% confidence level) (Figure 11).

On average, the warmest days location during 2023 was Rarawai Mil (Ba) with an annual mean maximum air temperature of 31.4°C, followed by Rotuma with 31.1°C, Lautoka Mill with 31.0°C, Yasawa-i-Rara with 30.9°C and Yaqara with 30.8°C. On the other hand, the coolest annual mean maximum air temperature was registered at Monasavu with 24.3°C, followed by Nadarivatu with 24.7°C, Ono-i-Lau with 28.8°C, Matuku with 29.0°C and Lakeba with 29.2°C.

The highest daily maximum air temperature during the year was recorded at Wainikoro with 36.6°C on January 5<sup>th</sup>, Rarawai Mill (Ba) with 36.2°C on January 19<sup>th</sup>, Koronivia and Yasawa-i-Rara both with 36.0°C on February 3<sup>rd</sup> and May 6<sup>th</sup>, respectively, and Yaqara with 35.4°C on December 4<sup>th</sup>.

The coolest nights on average during 2023 was recorded at Nadarivatu with the annual minimum air temperature of 17.1°C, followed by Monasavu with 18.2°C, Rarawai Mill (Ba) with 20.8°C and Sigatoka with 21.1°C. In contrast, the warmest nights on average were recorded at Udu Point with annual minimum air temperature of 24.4°C, followed by Rotuma with 24.0°C, Laucala Bay (Suva) with 23.3°C, Matuku with 23.0°C, and Yaqara and Lakeba both with 22.8°C.

# Air Temperatures (Cont.)

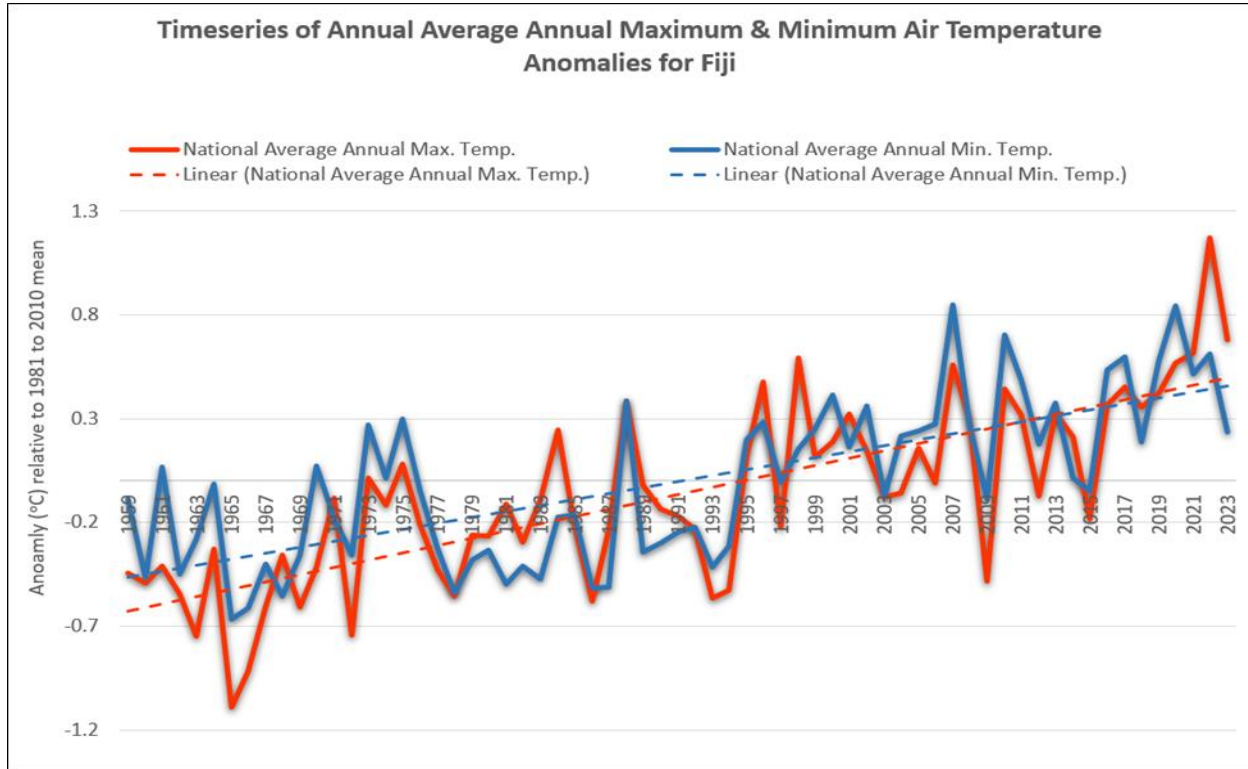


Figure 11: Time series of national average annual maximum and minimum air temperature anomalies of Fiji relative to 1981-2010 mean, together with the associated trends.

The lowest daily minimum air temperature for the year was experienced at Nadarivatu with 8.7°C on June 26<sup>th</sup> and August 25<sup>th</sup>, Nadarivatu with 9.5°C on July 1<sup>st</sup>, Monasavu with 10.1°C on June 27<sup>th</sup>, Nadarivatu with 10.4°C on July 30<sup>th</sup>, and Monasavu with 10.8°C on August 26<sup>th</sup>.

*Note: The national average mean, maximum and minimum air temperatures have been calculated based on in-situ observations at 5 high quality meteorological stations, namely, Nadi Airport, Rarawai Mill, Laucala Bay, Nausori Airport and Vunisea.*

# Sunshine

The annual sunshine hours were near normal at Nadi Airport, Laucala Bay (Suva), Doboilevu, Koronivia and Monasavu. The total annual bright sunshine hours at Nadi Airport, Laucala Bay, Doboilevu, Koronivia and Monasavu was 2489 hours, 1648 hours, 1590 hours, 1667 hours and 1157 hours, respectively (Table 1).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Nadi	166	126	208	240	196	205	189	185	207	258	241	269	2489
Suva	160	115	169	225	139	49	46	88	145	178	138	195	1648
Doboilevu	146	119	104	185	139	146	99	117	77	167	162	132	1590
Koronivia	161	127	167	178	134	115	74	81	142	150	135	202	1667
Monasavu	113	86	102	127	72	107	68	80	67	101	129	106	1157

Table 1: Total monthly and annual bright sunshine hours for 2023.

Nadi Airport recorded 100% of normal annual bright sunshine hours during the year. The station's highest total monthly bright sunshine of 269 hours was registered in December, while the lowest of 126 hours was in February (Table 1).

Doboilevu recorded 113% of normal bright sunshine hours during 2023. The station's highest total monthly bright sunshine of 185 hours was registered in April, while the lowest of 77 hours was in September (Table 1).

The annual total bright sunshine at Laucala Bay (Suva) was 88% of the normal. April was the sunniest month at Laucala Bay (Suva), with 225 hours of total bright sunshine, while July recorded the least with 46 hours (Table 1).

Koronivia experienced 123% of the normal sunshine hours during 2023. The sunniest month at Koronivia was December with 202 hours of bright sunshine, while the minimum was recorded in July with 74 hours (Table 1).

The annual total bright sunshine at Monasavu was 98% of the normal. The sunniest month at Monasavu was November with 129 hours of total bright sunshine, while September recorded the least with 67 hours (Table 1).

# Winds

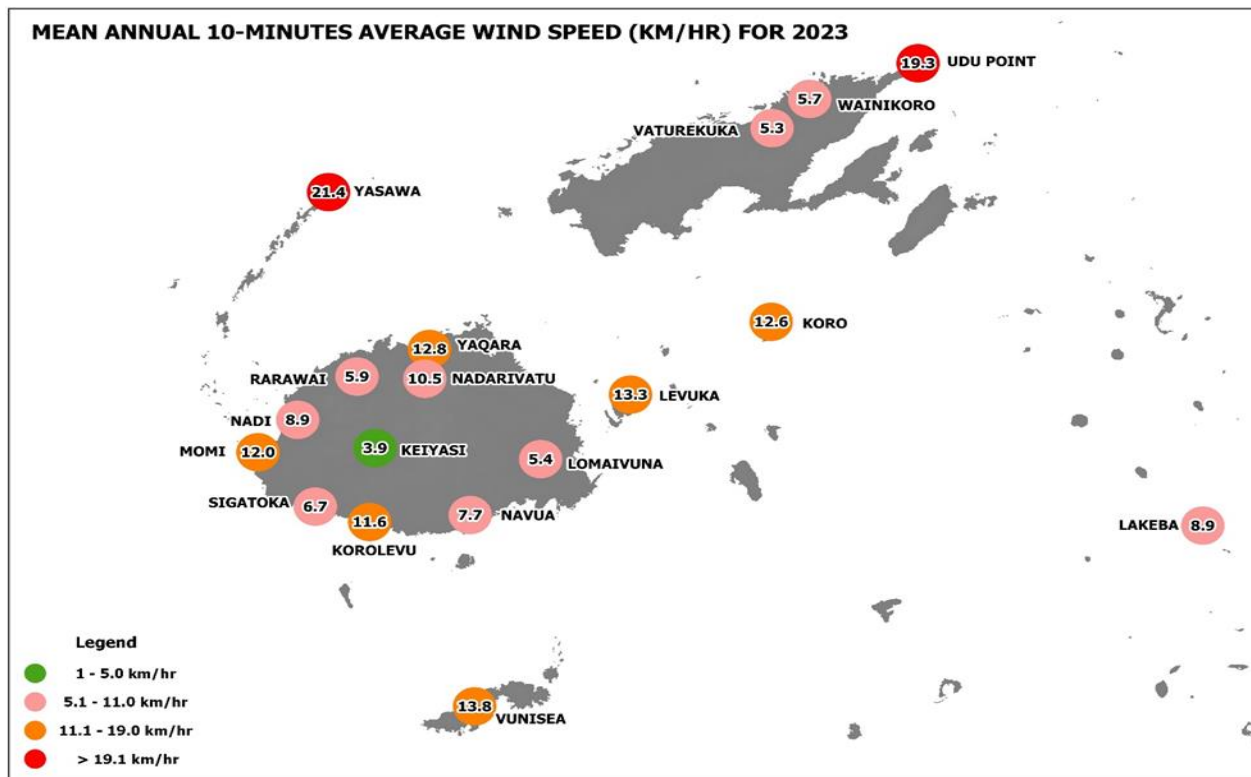


Figure 12: Mean annual 10-minute average wind speeds (km/hr) in 2023.

The highest 2023 mean annual 10-minutes wind speed was recorded at Yasawa-i-Rara with 21.4km/hr, followed by Udu Point with 19.3km/hr, Vunisea with 13.8km/hr and 13.3km/hr at Levuka. On the other hand, Keiyasi AWS recorded the lowest average winds of 3.9km/hr.

The most extreme wind during the year was registered during the passage of severe tropical cyclone (TC) Mal from 13<sup>th</sup> to 16<sup>th</sup> November. The highest recorded sustained wind was observed at Momi with 78km/hr, followed by Yasawa-i-Rara with 69km/hr, Nadi with 57km/hr and Nadarivatu with 54km/hr. The highest observed wind gust during the passing of TC Mal was at Momi with 112km/hr, followed by Nadi with 96km/hr, Nadarivatu with 93km/hr, Yasawa-i-Rara with 85km/hr, RKS Lodoni with 75km/hr, Korolevu with 74km/hr, Levuka with 73km/hr, and Udu Point with 70km/hr.

*Note: Not all wind reporting stations have been used for analysis due to missing data.*



# Tropical Cyclones (TCs)

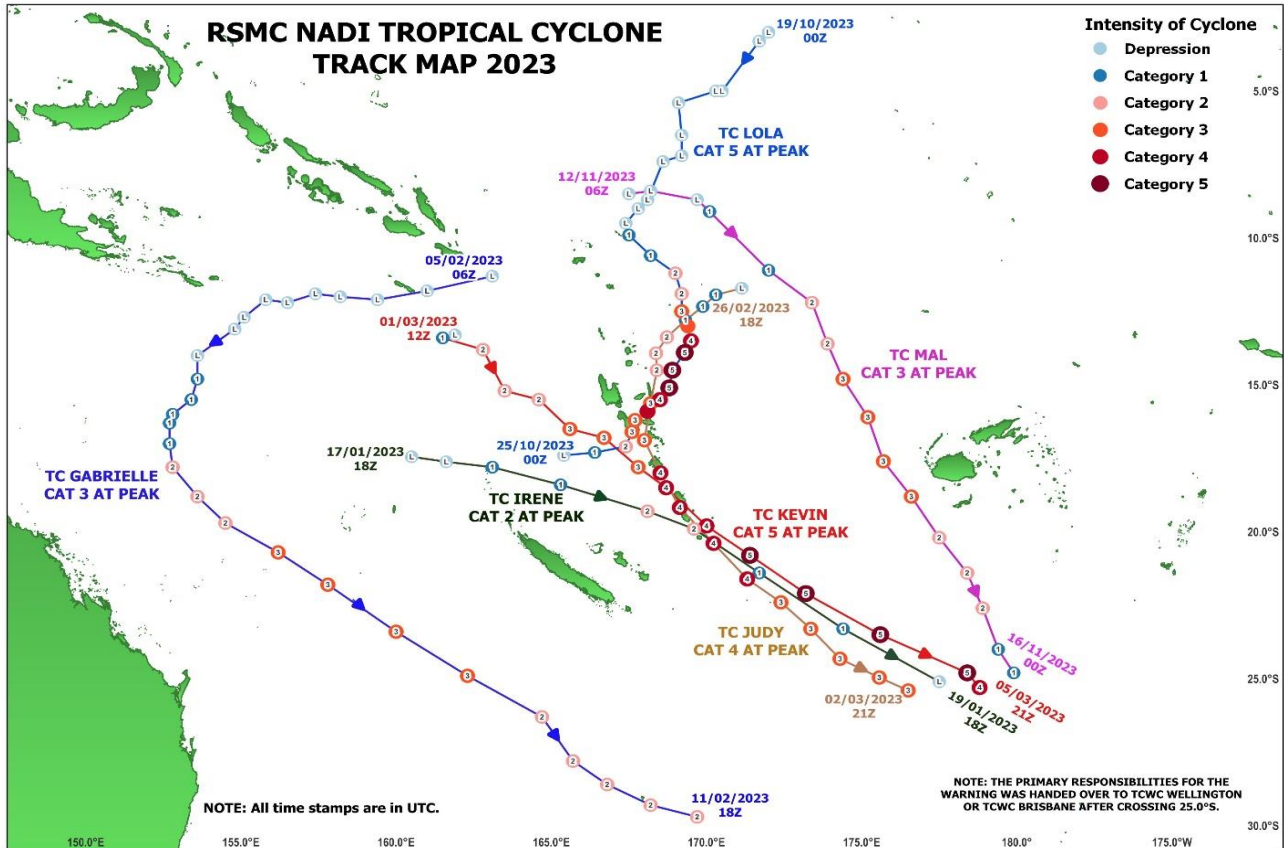


Figure 13: Track maps of TCs, which occurred in the RSMC Nadi-TCC area of responsibility during 2023.

In 2023, six TCs occurred in the Regional Specialised Meteorological Centre Nadi – Tropical Cyclone Centre (RSMC Nadi-TCC) area of responsibility (AoR) (Figure 13). Two Category 5 cyclones TC Kevin and TC Lola occurred while in the RSMC Nadi-TCC AoR, two Category 4 (Gabrielle and Judy), while TC Mal was Category 3 and TC Irene was Category 2. Only TC Mal had significant impact on Fiji as the associated gale force winds and torrential heavy rain brought flash flooding of low-lying areas, damaged weakly structured properties, infrastructures and livestock.

**TC Irene** originated from a low-pressure system that was analyzed over northern Vanuatu waters on January 14<sup>th</sup>. Irene was named on January 18<sup>th</sup> and attained maximum Category 2 intensity while it was in RSMC AoR. Irene caused flooding and power cuts across Port Villa in Vanuatu.

# Tropical Cyclones (Cont.)

**Severe TC Gabrielle** was named on February 8<sup>th</sup>, as it passed to the east of Willis Island in the Australian region. Gabrielle then turned to the south and then to the southeast. On February 10<sup>th</sup>, Gabrielle accelerated to the southeast intensifying into a Category 3 cyclone before transitioning into a sub-tropical cyclone. Gabrielle attained maximum Category 3 intensity while it was in RSMC AoR. Gabrielle caused widespread flooding, landslides and huge ocean swells in New Zealand, and as a result national state of emergency was declared in New Zealand. Eleven casualties were reported in New Zealand due to TC Gabrielle.

**Severe TC Judy** originated from a low-pressure system that was located south of Samoa on February 22<sup>nd</sup>. TC Judy was named on February 26<sup>th</sup> and attained maximum Category 4 intensity while it was in RSMC AoR. Judy caused extensive damages over land and coastal communities in Vanuatu. Very destructive winds, torrential rainfall and flooding affected the population in Vanuatu. Damages were inflicted on human lives, properties, infrastructures, livestock and agriculture, disruption in communication networks, power shut down, and communities being cut off due to flooding and land slide. Judy dissipated on March 4<sup>th</sup>.

**Severe TC Kevin** was named on March 2<sup>nd</sup>, while it was located closer to Vanuatu. Kevin rapidly intensified while drifting towards Vanuatu on March 3<sup>rd</sup> and made landfall over Erromango. Kevin attained maximum Category 5 intensity while it was in RSMC AoR. Kevin brought destructive winds and torrential rainfall in Vanuatu. The associated rain bands with TC Kevin also brought heavy rain with fresh to strong northerly winds over parts of the Fiji group, and as a result, parts of the western division, mainly Rakiraki and Ba experienced flash floods.

**Severe TC Lola** became the first cyclone to form outside the 2023/2024 cyclone season. Lola became the earliest Category 5 system to form in the month of October in the Southern Hemisphere as per recorded history, dating back to 1970. Lola was named on October 22<sup>nd</sup>, while it was traversing closer to Vanuatu. Lola made landfall on October 24<sup>th</sup> and affected 91,000 people in Malampa, Penama, Shefa and Torba provinces, with the Government of Vanuatu declaring a six-month state of emergency in these provinces.

# Tropical Cyclones (Cont.)

**Severe TC Mal** developed from an active trough just east of the Solomon Island group, evolving from a tropical low-pressure system. Mal, reached Category 1 status on November 13<sup>th</sup>, while situated over open waters, approximately 650 kilometers northwest of Rotuma. Mal reached peak intensity after six hours while located about 170 kilometers west of Kadavu or 140 kilometers southwest of Nadi. Mal reached the maximum intensity of a Category 3 system while it was in RSMC AoR. Mal was reclassified as an ex-tropical cyclone on November 15<sup>th</sup>. Mal brought significant damages to both land and coastal communities, especially in Yasawa-i-rara, Mamanuca Group, Western Viti Levu, Kadavu, and other parts of Viti Levu. Heavy rain was experienced in some areas before the arrival of gale force winds, causing flash flooding and landslides. Weakly structured properties and infrastructures, livestock, and agriculture suffered significant damages. There were isolated disruptions in communication networks and power shutdowns as well.

*Note: All date in this report is in Fiji Standard Time.*

# Sea Surface Temperatures (SSTs)

The presence of El Niño Southern Oscillation (ENSO) plays a significant role on the sea surface temperature in the tropical Pacific Ocean.

Generally, warmer than normal sea surface temperatures were present within Fiji's Exclusive Economic Zone (EEZ) in 2023. Warm anomalies between  $+1.0^{\circ}\text{C}$  to  $+1.5^{\circ}\text{C}$  were present west of Viti Levu and north of Vanua Levu, while anomalies around  $+0.5^{\circ}\text{C}$  to  $+1.0^{\circ}\text{C}$  were present for the rest of the Fiji Waters (Figure 14a). The annual mean sea surface temperatures around the Fiji Group ranged from  $26^{\circ}\text{C}$  to  $29^{\circ}\text{C}$  (Figure 14(b)).

In 2023, areas northeast of Fiji's EEZ registered record high mean annual sea surface temperatures since 1982 (Figure 15).

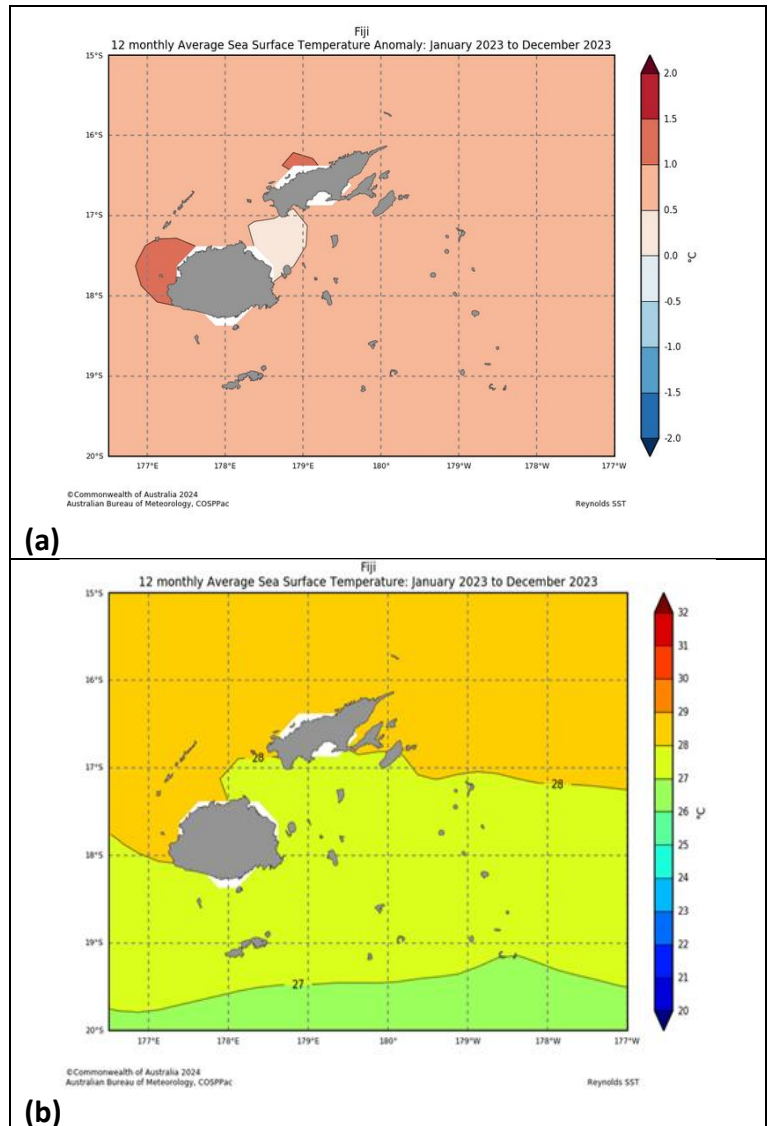


Figure 14: (a) Mean annual sea surface temperature difference from the normal (1971 to 2000 average); and (b) Mean annual sea surface temperature for 2023. Source: Pacific Community.

# Sea Surface Temperatures (Cont.)

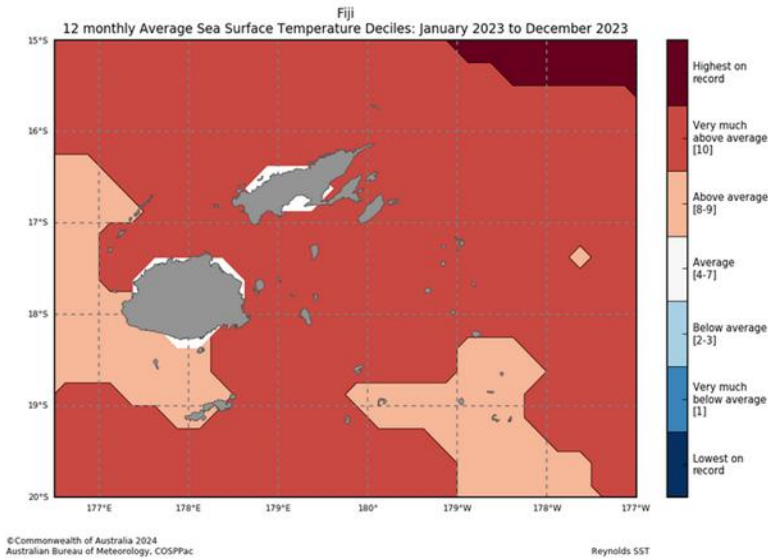


Figure 15: Ocean surface temperature ranking for 2023 since 1982. Source: Pacific Community.

The sea surface temperatures across the Fiji region showed a positive trend since 1950, with rise of 0.0 to 0.1°C/decade in most of Fiji’s EEZ and increase of 0.1°C to 0.2°C/decade across waters in Vanua Levu and north of Viti Levu (Figure 16).

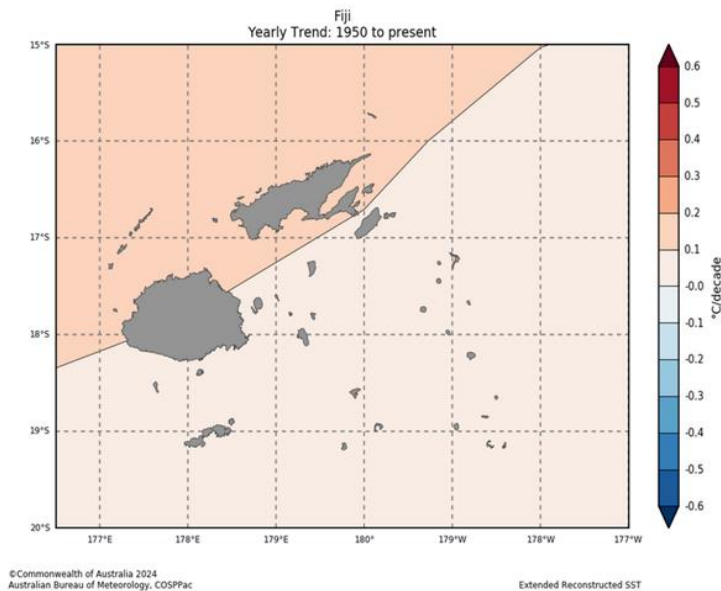


Figure 16: Average ocean surface temperature change since 1950. Source: Pacific Community.

# Sea Level

There are currently three (3) tide gauge stations available within the country. The first is available at Lautoka Wharf (Western Division), second is located at the Suva Wharf (Central Division), while the final one was installed at Vatia Wharf (Tavua). The first two stations belongs to the Pacific Sea Level and Geodetic Monitoring Project (PSLGMP), while the third station belongs to Fiji Met Service.

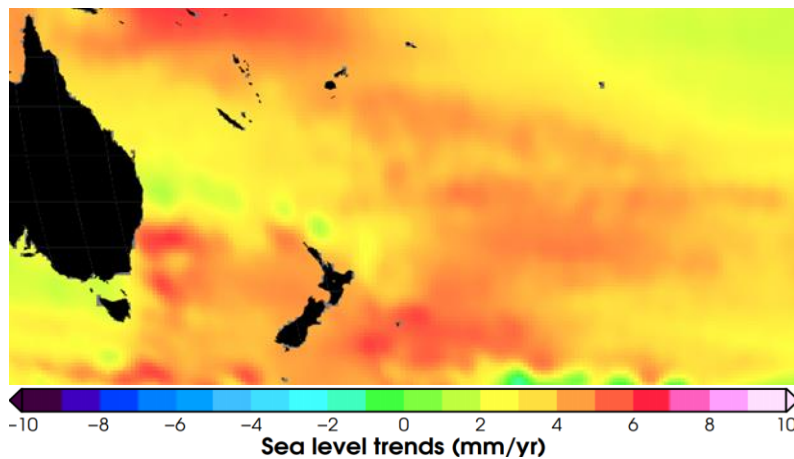


Figure 17: Sea level trend in the Pacific Island region between 1992 to 2023 as per the satellite measurement. Source: NOAA/Laboratory for Satellite Altimetry.

The sea-level rise near Fiji measured by satellite altimeters (Figure 17) from 1992 to 2023 was between 4-5mm/year. A state of the art sea level monitoring station at the Lautoka Wharf had a relative sea level trend of 4.3mm/year between 1993 to 2023, which is a statistically significant increasing trend at

95% confidence level (Figure 18). The global mean sea level rise is of 3.4mm/year since 1993.

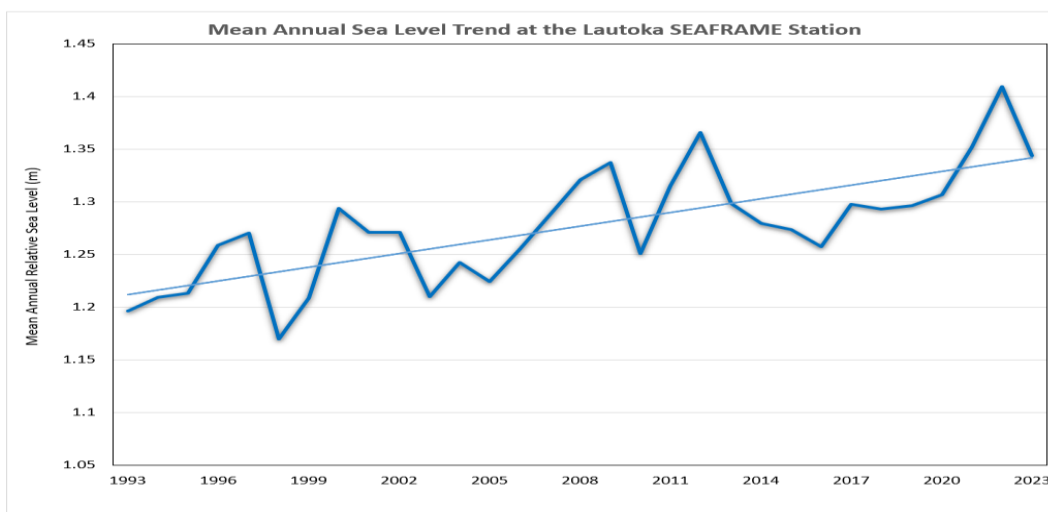


Figure 18: Mean annual relative sea level trend at the Lautoka SEAFRAME station. Data source: Pacific Community.

Note: Sea level at Vatia Wharf could not be analysed due to missing data.

# Notable Weather Events

## Flash Flooding in the Western and Northern Divisions – January

Two episodes of flash flooding were recorded over the Western and Northern Divisions during January.

The first episode of flash flooding occurred when an active convergence zone lying slow moving over the western parts of Viti Levu brought heavy rain from 1<sup>st</sup> to 5<sup>th</sup>. Major flash floods occurred around low-lying areas in some parts of the Western Division from Sigatoka to Rakiraki. Significant 24-hour rainfall of 231mm was recorded for Tavua, followed by 164mm at Nadarivatu, 133mm at Yasawa-i-Rara, 125mm at Rarawai Mill (Ba), 118mm at Lautoka Mill, 103mm at Yaqara all on the 2<sup>nd</sup> and 114mm at Nadi Airport on the 5<sup>th</sup>.

The second episode of flash flooding occurred between the 10<sup>th</sup> to 17<sup>th</sup> when a trough of low pressure to the north of the group, a trough to the west, and moist northwesterly wind flow affected most parts of the country with rain and showers which was heavy over some places causing flash floods. Major flash floods occurred at several crossings and roads in northern Vanua Levu and parts of Western Division. Significant 24-hour rainfall of 167mm was recorded for Seaqqa, followed by 134mm at Vaturekuka (Labasa), 109mm at Wainikoro and 108mm at Udu Point all on the 12<sup>th</sup>.

There was a reported case of drowning victims when an elderly couple drowned while trying to cross a flooded Irish Crossing at Maururu, Ba on the 13<sup>th</sup>.



Figure 19: (a) Toge Crossing in Ba on 5<sup>th</sup> January, 2023 (Picture Credit: Fiji Roads Authority); (b): Qelemumu Crossing in Wainikoro on 11<sup>th</sup> January 2023 (Picture Credit: Fiji Roads Authority).

# Notable Weather Events (Cont.)

## Storm Surge due to TC Irene and King Tide in Kadavu – January

TC Irene, in combination with the King Tide generated moderate swells over Fiji waters during the 21<sup>st</sup> to 24<sup>th</sup>, causing coastal inundation over some low-lying coastal areas. In addition, there were reports of coastal sea flooding on 20<sup>th</sup> at Vabea Village, in Ono, Kadavu.



Figure 20: (a) Tidal waves at Nabea Village, Ono in Kadavu (Picture Credit: Cevakeiviji); (b) Tidal waves at Nabea Village, Ono in Kadavu (Picture Credit: Cevakeiviji).

## Mini Tornado in Nasinu – January

An Australian reported a mini tornado on holiday in Fiji, while driving along Kings Road through the Nasinu area at 2.15pm on 12<sup>th</sup> January. Tornado was sighted underneath an approaching thunderstorm over Suva. The tornado did touch the ground and lasted for couple of minutes. There was no report of any damage or injuries during this period.

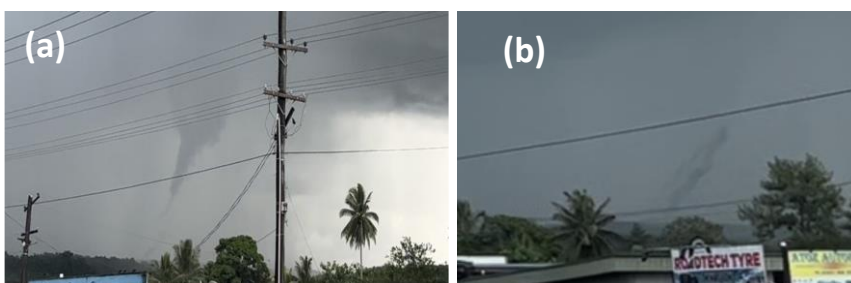


Figure 21 (a & b): A mini tornado in Nasinu on 12<sup>th</sup> January, 2023 (Picture Credit: Andrew Aubert).



# Notable Weather Events (Cont.)

## Flash Flooding in the Northern and Western Divisions – February

Three episodes of flash flooding were recorded over the country during February, especially across the Western and Northern Divisions.

The first episode of flash flooding occurred when a trough of low pressure with associated cloud and rain located to the north of Fiji gradually moved southwards over the northern and eastern parts of the country from the 2<sup>nd</sup> to 3<sup>rd</sup>. This resulted in significant rainfall being recorded at Seaqaqa with 203mm and Labasa Airfield with 156mm, both on the 3<sup>rd</sup>. Flash flooding occurred around low-lying areas of the Northern Division (Figure 22a to 22c).

The associated convergence zone, strong northwesterly winds and rain bands brought periods of rain over the Western division from 11<sup>th</sup> to 18<sup>th</sup>. During this period, major flash floods occurred at several crossings and roads in most parts of the Western Division (Figure 22d to 22g).

Significant 24-hour rainfall of 105mm was recorded at Nadarivatu on 12<sup>th</sup>, followed by 105mm at Lautoka on the 14<sup>th</sup>, 126mm at Nadarivatu on the 15<sup>th</sup>, 204mm at Tavua, 192mm at Yaqara, 189mm at Nadarivatu, 188mm at Lautoka Mill, 179mm at Momi, 156mm at Nadi Airport and 139mm at Rarawai Mill (Ba), all on the 16<sup>th</sup> and 190mm at Penang Mill on 17<sup>th</sup>.

Due to localised heavy rain, the third episode of flash flooding occurred in some parts of Rakiraki on the 22<sup>nd</sup> (Figure 22h to 22i).

There was a reported drowning victim when a 30-year-old farmer of Nayalayala settlement in Taveuni was swept away after he tried crossing a flooded river on the 4<sup>th</sup>.

# Notable Weather Events (Cont.)



Figure 22: (a) Flooding in Labasa town on 3<sup>rd</sup> February, 2023 (Picture Credit: Fiji Sun); (b) A vehicle swept away at Munir Road in Seaqaqa on 3<sup>rd</sup> February, 2023 (Picture Credit: Fiji Roads Authority); (c) Fallen coconut trees due to torrential rainfall in Siberia, Labasa on 3<sup>rd</sup> February, 2023 (Picture Credit: Fiji Roads Authority); (d) Flooding in Balevuto, Ba on 17<sup>th</sup> February, 2023 (Picture Credit: Fijivillage); (e) Nadi town inundated with flood-waters on 17<sup>th</sup> February, 2023 (Picture Credit: Fijivillage); (f) Flooding in low lying areas of Tavua on 17<sup>th</sup> February, 2023 (Picture Credit: Women's Weather Watch); (g) Rabulu road (Tavua) damaged due to continuous flooding on 17<sup>th</sup> February, 2023 (Picture Credit: Fijivillage); (h) Flash flooding in Rakiraki Town on 22<sup>nd</sup> February, 2023 (Picture Credit: Femlink Pacific); (i) Flooding in Rakiraki on 22<sup>nd</sup> February, 2023 (Picture Credit: Femlink Pacific).

# Notable Weather Events (Cont.)

## Landslide – February

The continuous heavy rainfall made the soil saturated and as a result, a number of landslides occurred across the country. Landslide occurred at Nadarivatu on 18<sup>th</sup> February and another landslide occurred at Nakabuta settlement, Kubulau road, Wainunu, Bua on 21<sup>st</sup> February. A landslide also occurred at Paipai, Lautoka following a heavy downpour on 23<sup>rd</sup> February, which disrupted travelling for more than 30 residents.



Figure 23: (a): Landslide in Nadarivatu on 18<sup>th</sup> February, 2023 (Picture Credit: Fiji Roads Authority); (b) Landslide at Nakabuta settlement, Kubulau road, Wainunu, Bua on 21<sup>st</sup> February, 2023 (Picture Credit: The Fiji Times); (c) Landslide in Paipai, Lautoka after heavy downpour on 23<sup>rd</sup> February, 2023 (Picture Credit: Fiji Sun).

The torrential downpour experienced during the beginning of June led to a major landslide at Narain Place off Wairua Road, Tamavua on 3<sup>rd</sup> June. Soil, massive rocks, fallen trees, and debris lying on the road, blocked access for motorists (Figure 24a). The landslide also caused a tree to fall on a power pole, affecting the power supply to the area (Figure 24b). Fortunately, there were no casualties reported.

## Notable Weather Events (Cont.)



Figure 24: (a) Massive rocks, soil and debris lying on the roadside due to the landslide on 3<sup>rd</sup> June, 2023 (Picture Credit: FBC News); (b) Trees falling over the power pole in Tamavua due to the landslide on 3<sup>rd</sup> June, 2023 (Picture Credit: FBC News).

### Landslide – July

Heavy rain experienced overnight led to a landslide at Wailoku Road, Suva on 27<sup>th</sup> July. Soil, massive rocks, fallen trees, and debris lying on the road, resulted in half road closure for motorists (Figure 25). Fortunately, there were no casualties reported.



Figure 25: Massive rocks, soil and debris lying on the roadside due to the landslide on 27<sup>th</sup> July, 2023 (Picture Credit: Fiji Roads Authority).

### Flash Flooding in the Central Division – August

The isolated heavy falls experienced during 15<sup>th</sup> and 16<sup>th</sup>, led to flash flooding in some parts of the Central Division (Figure 26a and 26b). Flash flooding caused traffic

## Notable Weather Events (Cont.)

congestions across Suva corridor on 15<sup>th</sup> August (Figure 26b). Unfortunately, there was a reported causality of a four-year-old boy who was swept away by strong currents whilst trying to cross a flooded creek with a relative in Sakoca, Nasinu on 16<sup>th</sup> August.



Figure 26: (a) Flash flooding in Rewa on 15<sup>th</sup> August, 2023 (Picture Credit: Fiji Roads Authority); (b) Traffic congestion due to flash flooding in Suva on 15<sup>th</sup> August, 2023 (Picture Credit: Fiji Roads Authority).

### Flash Flooding in the Western Division – September

Two episodes of flash flooding were recorded over the country during September, especially in parts of the Western Division and in Wainadoi.

The first episode of localized flash flooding of low-lying areas, especially over Wainadoi occurred due to isolated heavy falls on the 13<sup>th</sup> and 14<sup>th</sup> (Figure 27a-27b).

The second episode of flash flooding occurred on the 26<sup>th</sup> in parts of the Western Division. Flash flooding caused road closure and inaccessibility in these areas (Figure 27c-27d).

# Notable Weather Events (Cont.)



Figure 27 (a): Flash flooding in Wainadoi Village on 14<sup>th</sup> September, 2023 (Picture Credit: National Disaster Management Office); (b) Flash flooding in Wainadoi on 14<sup>th</sup> September, 2023 (Picture Credit: National Disaster Management Office); (c) Vuda Back Road 1st crossing, Lautoka on 26<sup>th</sup> September (Picture Credit: Fiji Roads Authority); (d) Narendra Singh Road 1st crossing, Nadi on 26<sup>th</sup> September (Picture Credit: Fiji Roads Authority).

## Flash Flooding due to Severe Tropical Cyclone Mal – November

Tropical Cyclone Mal was the second named tropical cyclone of the 2023/24 tropical cyclone season. Severe Tropical Cyclone Mal brought heavy rain in Fiji before the arrival of gale force winds, causing flash flooding in low-lying areas. Flash flooding was reported over Central and Eastern Divisions due to heavy rainfall on the 12<sup>th</sup> and 13<sup>th</sup>. On the 12<sup>th</sup>, RKS Lodon, Nausori Airport, Koronivia and Levuka recorded their highest 24-hour

# Notable Weather Events (Cont.)

rainfall of 178mm, 144mm, 116mm and 105mm, respectively. Several bridges and crossings were closed and inaccessible in these areas.



*Figure 28 (a): Fallen tree at Moala Street, Samabula on 13<sup>th</sup> November (Picture Credit: Fiji Roads Authority); (b) Bureta Bridge in Ovalau on 13<sup>th</sup> November (Picture Credit: National Disaster Management Office); (c) Qauia, Lami on 13<sup>th</sup> November (Picture Credit: National Disaster Management Office); (d) Marata Village, Wailoku on 13<sup>th</sup> November (Picture Credit: Fijivillage).*

## Flash Flooding and Landslides due to Severe Afternoon Convection – November

Flash flooding occurred on the 28<sup>th</sup> in parts of Navua in the Central Division due to heavy rainfall from severe afternoon convection in the highlands and southern side of Navua. Navua recorded its highest 24-hour rainfall of 442mm on the 27<sup>th</sup>. Flash flooding caused

# Notable Weather Events (Cont.)

road closure and inaccessibility in Navua. Landslide on Queens Road near Nakorovou Hill was also reported.

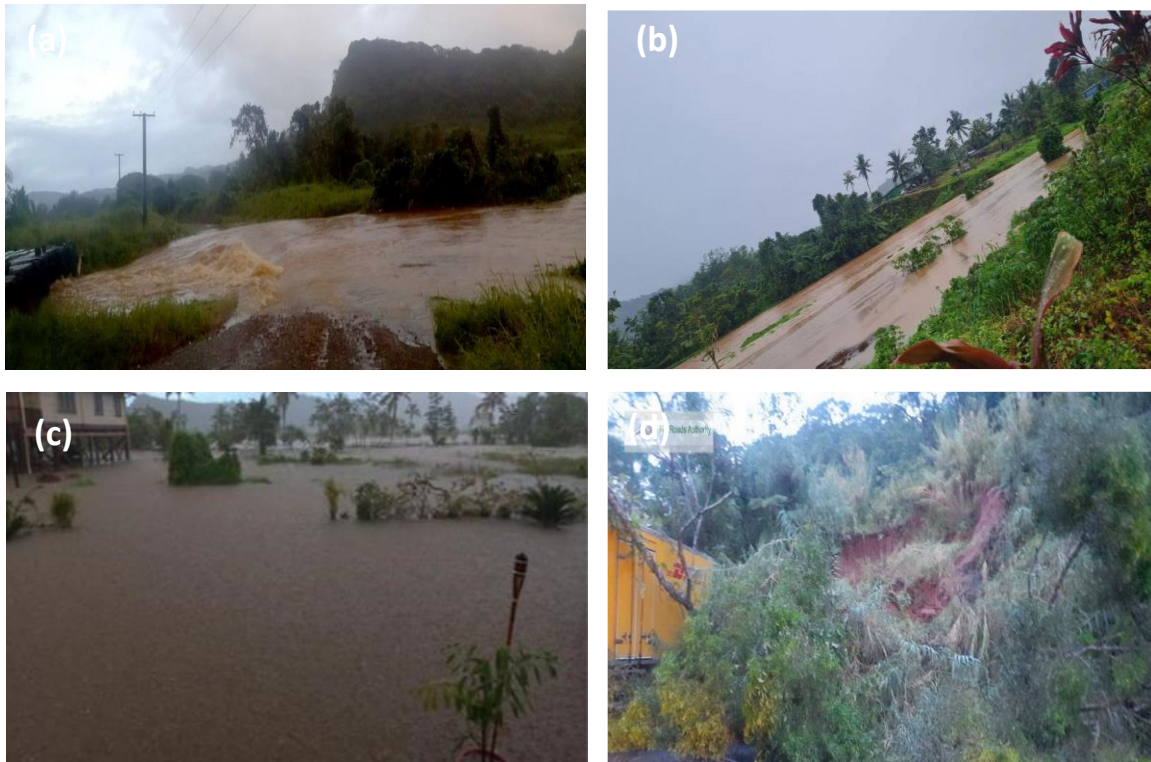


Figure 29 (a): Waiyanitu crossing 1 in Navua on 28<sup>th</sup> November (Picture Credit: Fiji Roads Authority); (b) Wainadoi, Navua on 28<sup>th</sup> November (Picture Credit: Fijivillage); (c) Calia, Navua on 28<sup>th</sup> November (Picture Credit: Fijivillage); (d) Landslide on Queens Road near Nakorovou Hill on 28<sup>th</sup> November (Picture Credit: Fiji Roads Authority).



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