



Climate, climate variability and change of Fiji Islands

Introduction

The Fiji Islands are located in the Southwest Pacific between 176°E - 178°W and 12°S - 21°S (Figure 1). There are more than 300 islands of which about 100 are inhabited. The two largest islands, Viti Levu and Vanua Levu make up 87% of the total landmass which is approximately 18,300 km². These islands are volcanic in origin and have high mountains with peaks up to 1324 m that have significant effect on the country's weather and climate.



Typical circulation features in the Southwest Pacific

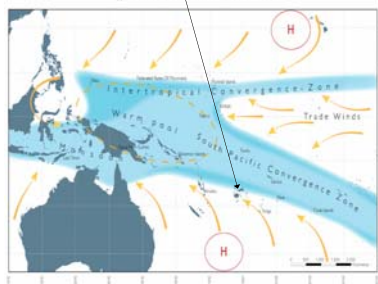


Figure 1: The Fiji Islands

(www.ck12.org/au/images/fiji-map.gif) Figure 2: Typical circulation features in the Southwest Pacific (PCCSP)

Data availability and homogeneity

The national meteorological network consists of 52 rainfall, 30 climate and 8 synoptic (hourly or 3 hourly observations) stations. A number of these sites have records which are suitable for climate variability and change studies. At least six sites have 100+ years of daily data.

Nadi Airport is located on the western (leeward) side of Viti Levu. More than 99% of possible observations are available.

Homogeneity tests were carried out on the Nadi Airport monthly rainfall, maximum and minimum temperature data. Rainfall and maximum temperature were found to be homogeneous. Three change-points (1965, 1977 and 1998) were detected in the minimum temperature record which are associated with changes in the observation site. The minimum temperature record was accordingly adjusted.

Climate Drivers

The main climatological features that affect Fiji are the South Pacific Convergence Zone (SPCZ), Monsoonal Trough, Trade Winds and El Niño Southern Oscillation (ENSO) (Figure 2).

Seasonal Cycles

Average monthly maximum, mean and minimum temperatures are strongly tied to changes in the surrounding ocean temperature (Figure 3). Fiji's annual mean temperature lies between 22 - 26°C with a seasonal range of about 2 - 4°C. The country experiences two distinct seasons. At Nadi Airport, an average of 77% of total annual rainfall is received in the wet/warm season from November to April.

The seasonal cycle is strongly driven by the SPCZ, which is most intense during the wet season. The southern edge of the SPCZ usually lies near Fiji (Figure 2). The effects of large-scale climate features such as the SPCZ and Trade Winds are modified on the larger islands due to the influence of mountains

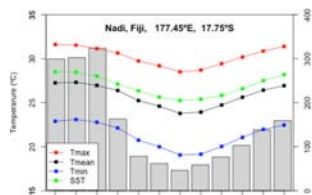


Figure 3: Mean annual cycle of rainfall (grey bars) and maximum (Tmax), minimum (Tmin), mean (Tmean) and sea surface temperatures (SST) at Nadi airport

Observed Inter-Annual Variability and Trends

Fiji's climate varies considerably from year to year with much of the variability associated with ENSO.

The trend in Nadi Airport annual, wet and dry season rainfall since 1942 is 4.7, 2.2, -6.2 mm/decade respectively (Figure 4). A slight +0.04°C/decade trend is observed in annual maximum temperature while a significant +0.14°C/decade trend is observed in annual minimum temperature (Figure 5).

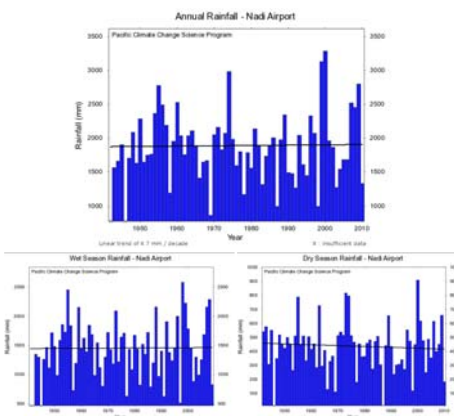


Figure 4: Annual, wet and dry season rainfall at Nadi Airport 1942-2010

Impacts and Extremes

Tropical cyclones, floods and droughts are the more notable climatic extremes that affect Fiji.



Effect of the 1997/98 drought on Viti Levu Sugarcane (left). Coastal erosion along Viti Levu's Coral Coast, mid-2008 (right). (Fiji Meteorological Service)

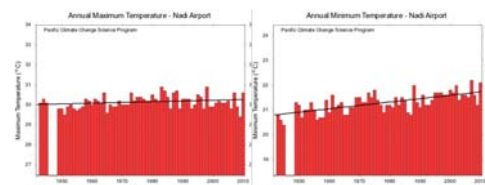


Figure 5: Annual maximum and annual minimum air temperature at Nadi Airport 1942-2010

Tropical Cyclones affect Fiji between November to April, and occasionally in October and May in El Niño years. Between the 1969/1970 and 2009/2010 seasons, 70 tropical cyclones (Figure 6) passed within 400km of Suva, usually from the north-west. This represents an average of 1.71 per season. Tropical cyclones were most frequent in El Niño years (1.94 per season) and least frequent in La Niña years (1.40 per season). The neutral season average is 1.64. The inter-annual variability in the number of tropical cyclones in the vicinity of Suva is large, ranging from zero in some seasons to five in 2002/03. This variability makes it difficult to confidently identify any long-term trends in frequency.

Recent studies suggest there is no trend in the frequency of major floods over the last century in Western Viti Levu. There is however significant inter-annual variability with greater numbers of floods occurring during La Niña events. Droughts usually associated with El Niño events were more severe during the recent positive phase of the Inter-decadal Pacific Oscillation from 1978 to 1997 compared to those that occurred during the negative phase from 1946 and 1977.

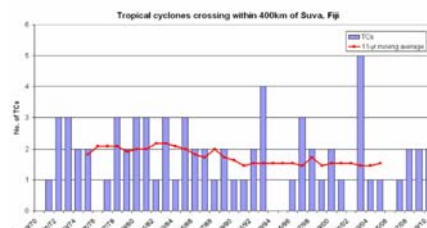


Figure 6: Tropical cyclones crossing within 400km of Suva. Eleven-year moving average in red

Other notable meteorological extremes include coastal flooding due to storm surges associated with significant tropical disturbances. The impacts of storm surges are mitigated to some extent by well developed coral reefs.