CLIMATE SUMMARY JANUARY 2016

Samoa Meteorology Division

Ministry of Natural Resources and Environment

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HIGHLIGHTS

- Drier than average rainfall recorded in January 2016. Majority of rainfall stations recorded 'well below average' rainfall (15/29) **Pg 1, & 2**
- Generally 'average to above average' rainfall received for the November 2015 to January 2016 period **Pg 3**
- Meteorological Drought still remains for Samoa. **Pg 8**
- 13.1°C was the lowest minimum temperature for Afiamalu on January 25th. Apia station recorded the hottest day temperature of 36.2°C on January 15th. **Pg 4**
- The mean atmospheric pressure for Apia was below normal. **Pg 4**
- Sea surface temperature and sub-surface temperature were cooler in January 2016 compared to December last year. **Pg 6**
- EL Nino remains strong but it is gradually decline. **Pg 7**
- 'Average to below average' rainfall is favored for the March to May 2016 period.

Figure 1: SPCZ Position in January 2016

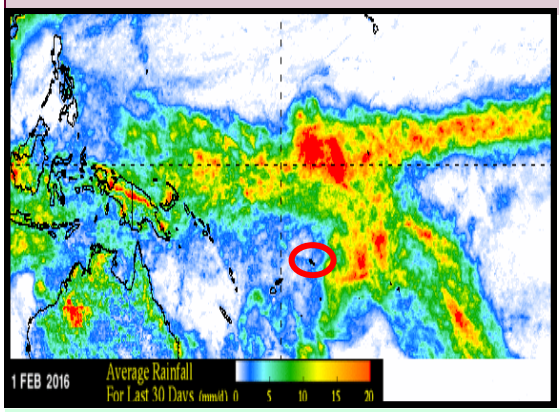
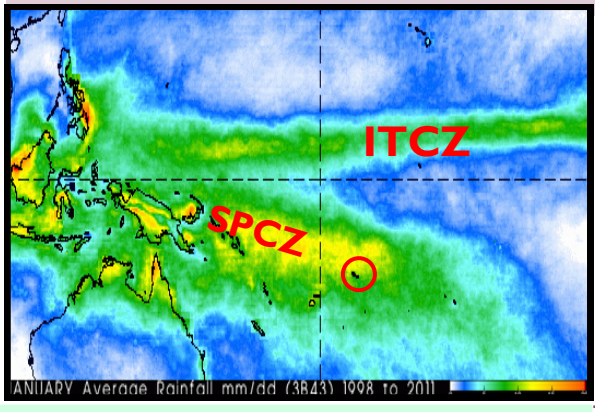


Figure 2: Average/Normal Position of SPCZ in January



The South Pacific Convergence Zone (SPCZ) was evidently displaced northeastward of its normal position in January 2016 as shown in both Figure 1 and Figure 2. The SPCZ merged with the Inter-tropical Convergence Zone (ITCZ) eastward of the International Dateline. The repositioning of the two major convergence zones was a feature over the last half of 2015 and was similar to what occurred in the strong El Nino events of 1982-83 and 1997-98. Conversely, this shift also caused suppressed rainfall covered much of the Papua New Guinea and areas to the southeast including Fiji and Samoa. Similarly, the northern Pacific islands such as Palau and Micronesia were also experiencing dry conditions due to suppressed rainfall in January 2016.

Samoa experienced drier than normal rainfall in January. Generally, most of the rainfall stations recorded 'well below average' rainfall (15/29), **12/29** received **'below average'**, Samalaeulu registered **'average'** and Salailua receiving **'above average'** rainfall. Laulii and Leauvaa recorded their lowest January total rainfall of 79.3mm and 111.2mm respectively since establishment. On the other hand, it is also the second driest January for Apia (2/127) and Nafanua (2/42). January 1st was the wettest day for all stations due to the development of Tropical Cyclone (TC) Ula within the vicinity of Samoa.

Moreover, the three-months accumulated total rainfall from the period of November 2015 to January 2016 was generally 'average' to 'above average' due to the development of TC Tuni (November 2015) and TC Ula (December 2015) near Samoa (Table 2). Salailua in Savaii recorded 'well above average' and Saletele Fagaloa received 'below average'. Tiavea-Uta recorded to be the wettest station during this three months period.

Rainfall Observations

Table 1: Rainfall Statistics in January 2016

This table displays the rainfall status of all stations in the country in January 2016

Stations	January Rainfall (mm)	January 30 Year Long Term Average	% of Average	1 day fall (mm)	Date	# of Rainy Days	Rainfall Status
UPOLU							
Faleolo	114.5	331	35	20	2nd	16	Well Below Average
Nuu	110.2	627	18	21.8	1st	12	Well Below Average
Nafanua	113.4	534	21	25.9	12th	23	Well Below Average
Afiamalu	350.5	732	48	47.1	23rd	23	Well Below Average
Apia	85.6	476	18	23.8	1st	12	Below Average
Alafua	129.8	551	24	36.9	12th	18	Well Below Average
Laulii	79.3	571	14	16.3	8th	12	Below Average
Saoluafata	76.5	195	39	15.0	16th	12	Well Below Average
Saletele	139.8	484	29	30.2	14th	25	Well Below Average
Ti'avea Uta	179.8	456	39	24.0	15th	20	Well Below Average
Nuusuatia	388.6	363	107	30.2	1st	17	Well Below Average
Salani Falealili	144.6	251	58	21.2	1st	20	Well Below Average
Lepa	116.4	458	25	24.6	2nd	19	Well Below Average
Lotofaga	102.8	328	31	20.5	19th	8	Well Below Average
Saleilua	249.4	503	50	80.0	2nd	17	Below Average
Togitogiga	249.9	473	53	36.2	1st	30	Below Average
Vailoa Aleipata	87.2	204	43	23.4	8th	21	Well Below Average
SAVAII							
Samalaeulu	161.0	158	102	49.6	25th	17	Average
Asau	172.0	476	36	23.0	1st	15	Well Below Average
Aopo	176.2	362	49	41.0	1st	16	Below Average
Letui	97.2	242	40	43.4	1st	13	Below Average
Vaiaata	198.0	514	39	44.8	1st	22	Well Below Average
Tuasivi	122.2	233	52	26.8	1st	18	Below Average
Salailua	821.6	587	140	134.4	8th	23	Above Average
Maota	352.6	460	77	100.0	1st	11	Below Average

Note: Rainfall statuses are defined as follows (deviation from average (in percentage));

Well Below Average	Below Average	Average	Above Average	Well Above Average
< 40%	40-80%	80%-120%	120-160%	> 160%

Figure 3: Rainfall Status Map in January 2016

This rainfall map is generated using data from Table 1

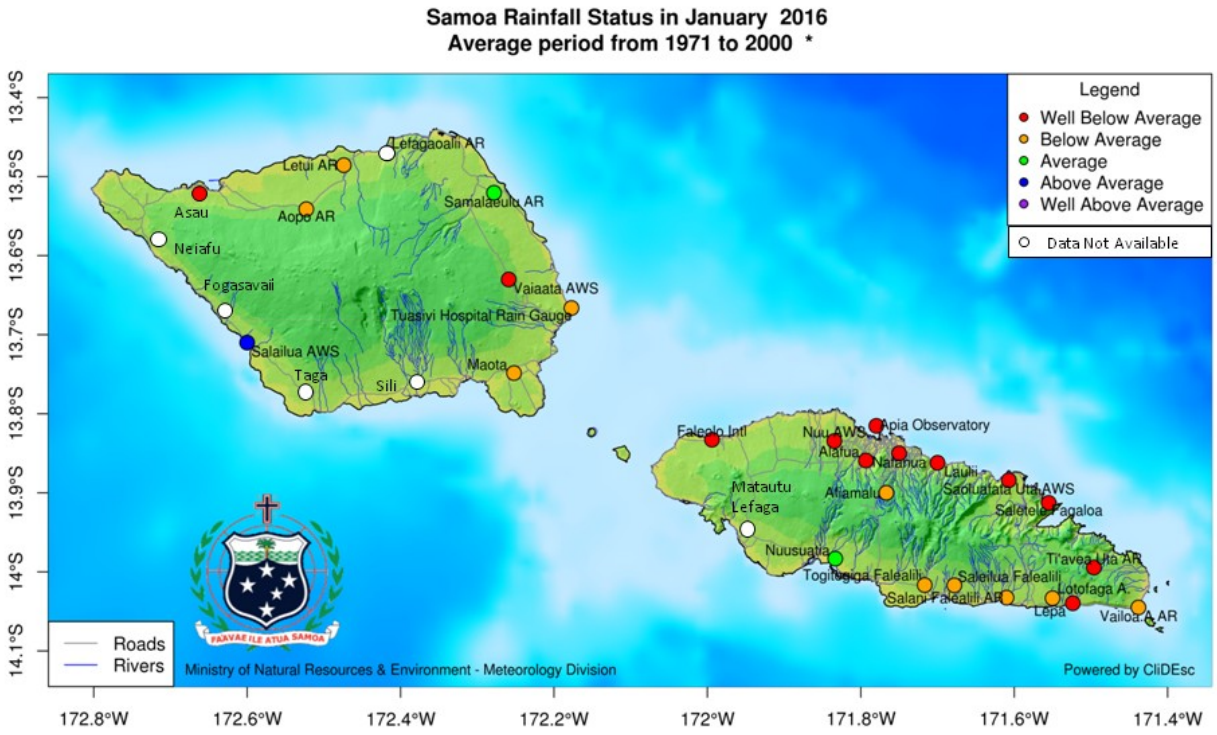


Table 2: Three Monthly Seasonal Rainfall - November 2015 to January 2016 period

This table displays the status of the rainfall in the last three months—November 2015 to January 2016

Stations	Three Monthly Total Rainfall	Long Term Average	% of Average	Rainfall Status
Afiamalu	1871.6	1744	107	Average
Afulilo*	1826.0	1299	141	Above Average
Alafua	1264.3	1354	93	Average
Apia	1172.4	1101	106	Average
Faleolo	968.8	759	128	Above Average
Laulii*	1311.2	1320	99	Average
Lotofaga*	1543.1	1139	136	Above Average
Nafanua	1345.2	1294	104`	Average
Nuusuatia*	1135.8	1025	111	Average
Salailua	1490.6	680	219	Well Above Average
Salani	1554.4	1139	137	Above Average
Saleilua	1720.4	1496	115	Above Average
Saletele*	1289.9	1813	71	Below Average
Tiavea Uta*	1826.0	1299	141	Above Average

Temperature & Atmospheric Pressure Observations

Table 3: Air Temperature Statistics

This table displays the temperature statistics recorded across stations in January 2016

Stations	Temperature (Degree Celsius)				
	Mean Daily Temperature	Extreme T Max	Date	Extreme T Min	Date
Faleolo	28.3	33.0	28th	22.9	8th
Nafanua	N/A	N/A	N/A	20.1	8th
Afiamalu	22.7	28.5	11th	13.1	25th
Apia	29.1	36.2	15th	23.0	31st
Alafua	28.1	33.8	7th	21.7	30th
Togitogiga	N/A	N/A	N/A	22.5	25th
Vaiaata	26.6	32.8	1st	19.3	8th
N/A = Data Not Available					

The mean daily temperatures for all stations ranges from 22.7 °C to 29.1°C. The most extreme maximum air temperature of 36.2°C was recorded at Apia on January 15th with the lowest maximum at Afiamalu. Afiamalu was also registered as the coolest location across the country recording a lowest minimum temperature of 13.1°C on January 25th. The other stations recorded minimum temperatures between 19.3°C to 23.0°C across the month. January 8th recorded as the coolest morning at Vaiaata, Nafanua and Faleolo.

Table 4: Atmospheric Pressure at Mean Sea Level (MSL)

This table displays the atmospheric statistics recorded across two stations in January 2016

Station	Highest MSL Pressure (hPa)	Date	Lowest MSL Pressure (hPa)	Date	Average MSL Pressure (hPa)
Apia	1015.7	21st	999.1	1st	1007.3
Faleolo	1014.5	30th	999.2	1st	1007.3

Apia and Faleolo recorded mean atmospheric pressures of 1007.3hPa. The mean atmospheric pressure recorded for January at Apia was below its long term average of 1009.0hPa. The lowest MSL Pressure recorded on January 1st was due to the development of TC Ula southeast of Apia.

(Note: High pressure systems associate with good weather conditions whereas low pressure systems associate with bad weather conditions)

Wind Observations

Figure 6: Wind Speed and Directions

The following diagrams show the different wind speed and direction that recorded across the country in January 2016

Figure 6a : Apia Station

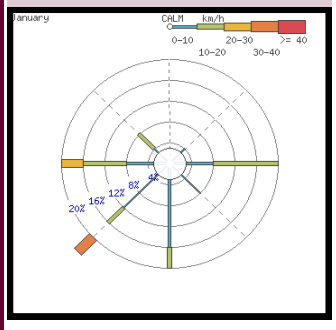


Figure 6b: Faleolo Station

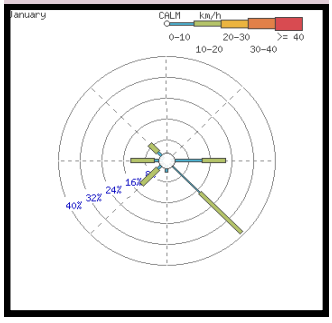


Figure 6c: Afiamalu Station

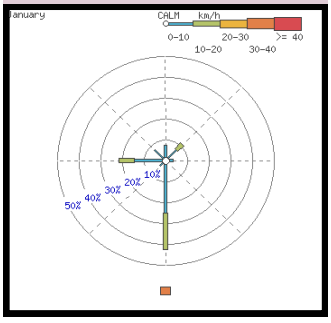


Figure 6d: Salailua Station

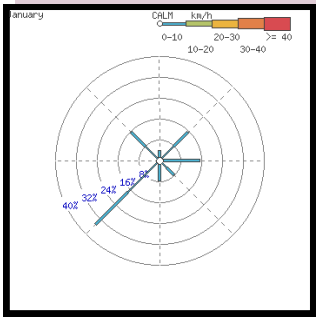


Figure 6e: Nafanua Station

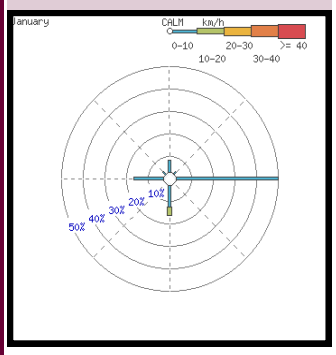


Figure 6f : Togitogiga Station

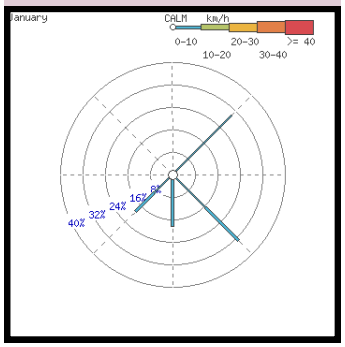


Figure 6g : Vaiaata Station

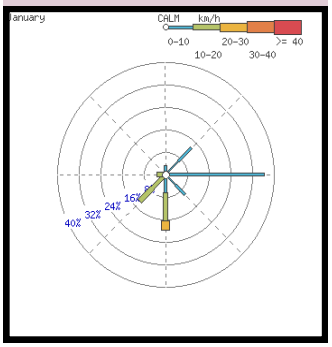
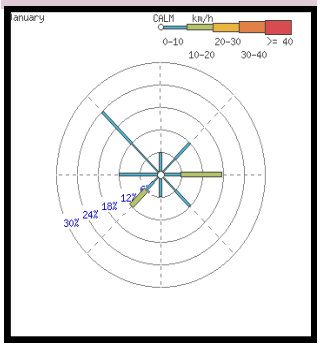


Figure 6h: Nuu Station



1. Figure 6a: Easterlies, southerlies and westerly winds dominated most of the time in Apia with light winds of 0-10km/hr and gentle winds of 10-20km/hr the most common wind speed experienced. Moderate winds of 20-30km/hr wind was observed from the west and gusty strong wind greater than 40km/hr directed from the southwest direction for a brief time.
2. Figure 6b: South easterly winds dominated Faleolo station accounted for 34% of the time. South west to north westerly winds were also recorded at 16% of the time.
3. Figure 6c: The dominant wind were directed from the south accounted for 42% of the time and the second dominant wind was from the west at 22%. Gusty wind directed from the south was recorded accounted for 4% of the time.
4. Figure 6d: South westerly accounted for most of the time in January (34%). Southerlies to north easterlies light winds of 0-10km/hr were also present at less than 16% of the time.
5. Figure 6e: The easterlies prevail over Nafanua station in January 2016 whereas northerlies, westerly winds and southerlies were less dominant.
6. Figure 6f: Northeast to south east winds took up much of the time in January at Togitogiga station. Light winds of 0-10km/hr and gentle winds of 10-20km/hr were the most experienced winds throughout January.
7. Figure 6g: Easterlies of light winds speed dominated Vaiaata station with the southerly winds recorded to be the less predominant wind.
8. Figure 6h: North easterly winds accounted for the most time at Nuu station (24%), easterlies present for 16% of the time and westerly winds, south westerly, and north easterly accounted for 12% of the time equally. Northerly and southerly winds were the least predominant winds registered.

Sea Surface & Sub-surface Temperature Observations

Figure 7: Sea Surface Temperature in January 2016

The sea surface temperature anomaly in December 2016 adapted from Bureau of Meteorology, Australia

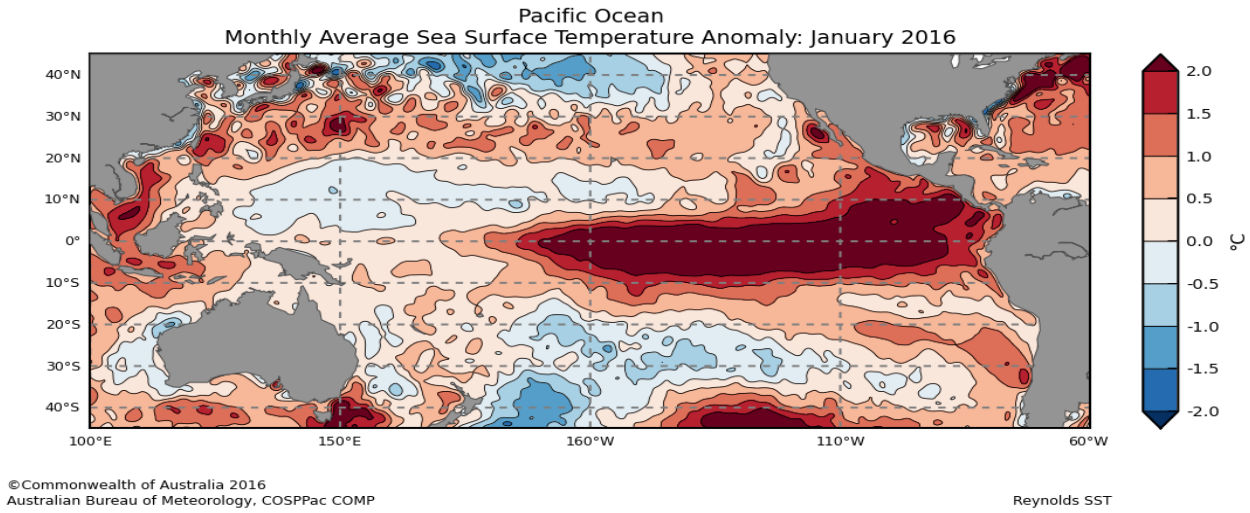


Figure 8: Sub Sea Surface Temperature in January 2016

The sub surface temperature anomaly in January 2016 adapted from Bureau of Meteorology, Australia

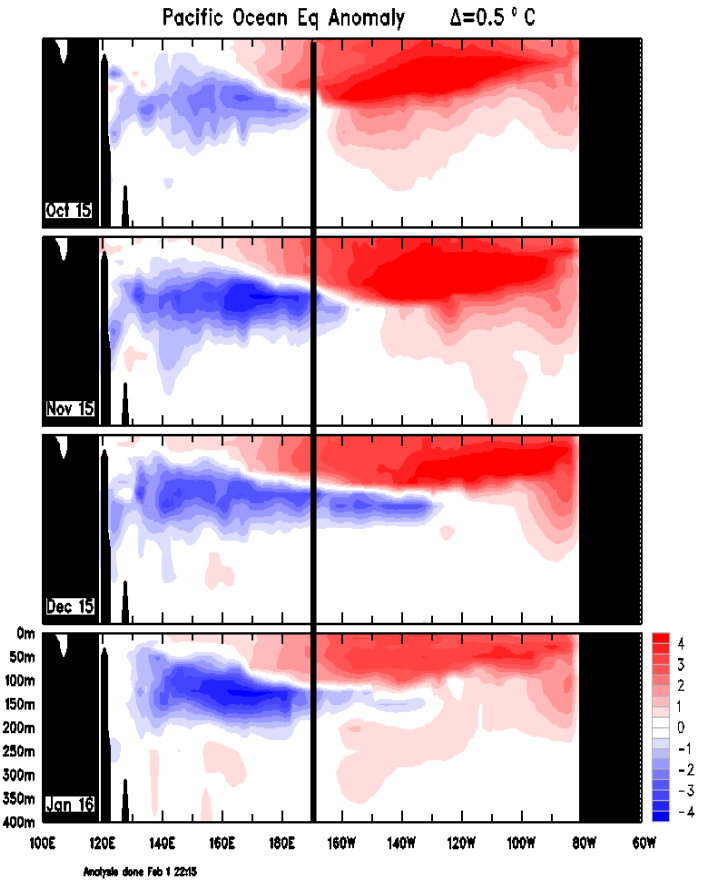
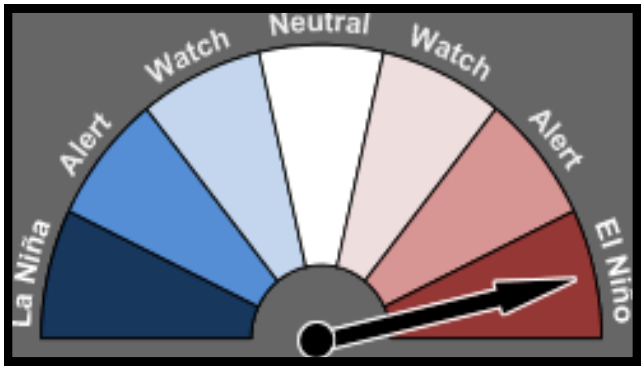


Figure 7 shows warmer than average sea surface temperature (exceed 2) in the central and eastern Pacific, but have weakened from the peak values in November—December 2015. Cooler anomalies were assembled to the east of New Zealand and further eastward to 110W. The latest monthly SST anomalies in the Nino3.4 is at +2.14°C, while the NIno3 Region is currently sitting at +2.03°C. The Nino4 index value is +1.0°C. The water surround Samoan region recorded 0.5 to 1.0°C warmer.

The four-month sequence of sub-surface temperature anomalies (to 16th January) shows a decline in the warmer than average water that was aggregated in the eastern equatorial pacific since the beginning of 2015. On the other hand, large bodies of cooler than average waters are building up from 120°E to 180°E extended to a depth of 200m and moving eastward. The sub-surface temperature for Samoan waters (vertical bold line) in January was warmer than normal at a depth of 100m then cooler waters were recorded between 150m and 200m.

El Nino Southern Oscillation (ENSO) Status



"The El Nino still remains strong, however it is gradually declining."

In the equatorial region, the sea surface temperature has cooled by 0.5°C since the El Nino peaked in late 2015. Technically, January's sea surface temperature (SST) anomaly values for Nino 3 were +2.1°C (cooler by 0.3°C), Nino 3.4 +2.2°C (down by 0.1°C) and Nino 4 +1.3°C (down by 0.3°C). Moreover, significant cooling of the sub-surface sea temperature was also observed in January compared to December. During January, warm anomalies were present in the top 150m of the equatorial Pacific sub-surface extending between about 170°E and South American coastline. Cool anomalies for January covered much of the western Pacific at around 150 m depth, with a narrow area of cool anomalies underlying warm anomalies in the central region. The Southern Oscillation Index (SOI) value recorded in January was –19.7. It has been below –5 since March 2015; these values remain typical of an El Nino.

Historically, 50% of past El Nino events have been followed by a neutral year and 40% have been followed by La Nina. Climate models suggests a return to neutral state is the most likely outcome for the second half of 2016.

IMPACTS OF EL NINO IN SAMOA

- Below normal rainfall receive which may lead to drought and forest fires.
- Higher than normal day time temperature over the country
- Decrease sea level and increase possibility of coral bleaching in the marine environment
- Increase numbers of tropical cyclones

The following sectors could be severely impacted as a consequence of rainfall deficit:

- Water
- Agriculture
- Health
- Energy (Hydro Power),
- Tourist (Accommodation Facilities)
- Forestry

SEASONAL RAINFALL OUTLOOK FOR OCTOBER TO DECEMBER 2015 PERIOD

"Average to Below Average" rainfall is predicted and forecast by the Seasonal Climate Outlook Prediction (Statistical) Model (SCOPIC) alongside with POAMA model rainfall over Samoa for the next 3 month period—March to May 2016.

(Refer to detailed discussion in the Seasonal Rainfall Outlook Report for March to May 2016 period)

DROUGHT MONITORING & ANALYSIS

Table 5: Monthly rainfall status observed from November 2015 to January 2016 period, drought status and forecast

This table displays the status of rainfall in each month of the previous three monthly period (November 2015 to January 2016) and using their status to determine their drought status as well as the rainfall forecast for the next three months.

Climate Stations	Rainfall Observed			Current Drought Status and Warning	Rainfall Forecast for March to May 2016
	November 2015	December 2015	January 2016		
Faleolo					
Leauvaa					
Nuu					
Nafanua					
Afiamalu					
Apia					
Alafua					
Laulii					
Tiavea					
Nuusuatia					
Salani					
Lotofaga					
Togitogiga					
Vailoa Aleipata*					
Samalaeulu					
Vaiaata					
Tuasivi*					
Salailua*					
Maota					

KEY FOR DROUGHT	Normal/Not in Drought	Drought Watch	Meteorological Drought	Drought Easing
KEY FOR RAINFALL	Drier than Normal	Normal	Wetter than Normal	

Based on rainfall outlook, areas that are in **Meteorological Drought** will remain in dry conditions for the next three months. **Drought watch** and **Drought easing** areas have a high possibility of moving into Meteorological Drought. However, **Normal/Not In Drought** areas have little or no possibility to move into drought conditions.

"Meteorological Drought" is declared when rainfall is below average (drier than normal) for three consecutive months. **"Meteorological Drought Watch"** is issued when the last two months of three monthly period receive below average rainfall. "**Drought Easing"** happens when the first and second month of the three monthly period are below average, but the third month is either normal or wetter than normal. **"Normal/Not in Drought"** is when two or more months receive normal to wetter than normal conditions.

Additional Information

Meteorological drought is defined usually on the basis of the degree of dryness (in comparison to some "normal" or average amount) and the duration of the dry period. Meteorological drought is the first of four levels of severity or definitions. The more severe drought definitions are Agricultural Drought, Hydrological Drought and Socio-economic Drought.

Agricultural Drought

Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapo-transpiration, soil water deficits, reduced groundwater or reservoir levels, and so forth.

Hydrological Drought

Hydrological drought is associated with the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply (i.e., stream flow, reservoir and lake levels, groundwater). The frequency and severity of hydrological drought is often defined on a watershed or river basin scale. Although all droughts originate with a deficiency of precipitation, hydrologists are more concerned with how this deficiency plays out through the hydrologic system. Hydrological droughts are usually out of phase with or lag the occurrence of meteorological and agricultural droughts. It takes longer for precipitation deficiencies to show up in components of the hydrological system such as soil moisture, stream flow, and groundwater and reservoir levels. As a result, these impacts are out of phase with impacts in other economic sectors.

Socioeconomic Drought

Socioeconomic definitions of drought associate the supply and demand of some economic good with elements of meteorological, hydrological, and agricultural drought. It differs from the aforementioned types of drought because its occurrence depends on the time and space processes of supply and demand to identify or classify droughts. The supply of many economic goods, such as water, forage, food grains, fish, and hydroelectric power, depends on weather. Because of the natural variability of climate, water supply is ample in some years but unable to meet human and environmental needs in other years. Socioeconomic drought occurs when the demand for an economic good exceeds supply as a result of a weather-related shortfall in water supply.